# Advancing Research on Virtual Collaboration

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# DOCTORAL THESIS

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| Title | Advancing Research on Virtual Collaboration |
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*"Somos nuestra memoria, ese quimérico museo de formas inconstantes,*
*ese montón de espejos rotos"*
Jorge Luis Borges

*"On ne voit bien qu'avec le coeur. L'essentiel est invisible pour les yeux."*
Antoine de Saint-Exupéry – Le Petit Prince

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# Abstract

Although virtual environments were not new to some organizations, when the COVID-19 pandemic hit, almost every industry on the globe began employing them. Given that many organizations and employees will work remotely permanently (or at least to some extent) in the future, one of the most significant challenges organizations will face is facilitating individual and team performance in virtual environments. Virtual environments may enable organizations to maximize their human capital and enhance their knowledge, resources, collaboration, and creativity to meet their stakeholder's demands. Nevertheless, when team members rely on technology-mediated communications, they encounter additional challenges that impact collaboration and performance. Thus, it is critical to understand the aspects that contribute to individual and team collaboration in virtual environments. The main purpose of this thesis is thus to advance research on virtual collaboration. More specifically, this thesis addresses the following overarching research question: What factors promote effective collaboration in a virtual context? To address this question, this thesis is divided into six chapters, of which the main part is a compendium of three essays (Chapters 2, 3, and 4). The first chapter of the thesis is the general introduction. The second chapter focuses on individual-level factors that enable the effectiveness of virtual collaboration (gender and situational judgment). The third chapter focuses on team-level factors that promote virtual collaboration effectiveness (team virtual communication behaviors and team information sharing). The fourth chapter focuses on dyadic-level factors that promote effective virtual collaboration (interpersonal expectations and forgiveness for lengthy response times). Finally, the fifth chapter presents the general conclusions, limitations, and future research directions. This thesis contributes to the literature on collaboration in virtual environments by examining understudied contemporary phenomena at different levels of analysis (e.g., gender, traditional face-to-face student teams, and unresponsiveness effects) from various theoretical and methodological perspectives. Overall, this thesis provides insights helpful to individuals and teams working in virtual environments.

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# 1. General Introduction

## 1.1. Introduction

Organizations increasingly rely on virtual work arrangements (e.g., telecommuting, mobile work, virtual teamwork) to compete globally for employees, suppliers, and customers (Gibson et al., 2014a; Gibson & Cohen, 2003; Gilson et al., 2015; Kirkman et al., 2012; Raghuram et al., 2019). The COVID-19 pandemic accelerated this trend, and, as a result, many employees are currently working from home and anticipate continuing to do so long in the future (Gardner & Matviak, 2020; Laker, 2020; Rue, 2020). *Virtual workers* are employees who communicate primarily via computer-mediated technologies. *Virtual teams* are team members who work on interdependent tasks, share responsibilities, and communicate mainly via technology-mediated mediums (Gibson & Cohen, 2003).

Although the pandemic forced organizations and employees to adapt their work to virtual environments, for decades, the use of virtual teams enabled organizations to select from a diverse pool of high-quality talent located around the world while also providing greater flexibility, cost savings, and enhanced communication resources (Kirkman et al., 2012). Research suggests that because virtual teams communicate primarily through technology-mediated media and frequently lack face-to-face communication characteristics (e.g., non-verbal communication cues), compared to traditional face-to-face teams, they face additional challenges related to team processes (e.g., team information sharing), team emergent states (e.g., team trust) and, ultimately, team outcomes (e.g., team performance and satisfaction) (Gibson et al., 2014b; Gibson & Cohen, 2003; Hinds et al., 2011).

Virtual workers' and team members' dependence on technology means that their task progress is vulnerable to collaboration challenges such as communication misunderstandings that may undermine team dynamics and outcomes (Cramton, 2001). A growing body of literature recognizes communication and collaboration as critical processes for team performance (Kozlowski & Bell, 2012; Kozlowski & Ilgen, 2007; Marks et al., 2000; Marlow et al., 2018). Communication has been defined as the process of two or more team members exchanging information (Marks et al., 2001; Salas et al., 2005). Prior research has indicated that poor communication can hinder team members' relationships and team processes, such as collaboration (Kozlowski & Ilgen, 2007). As such, over the past few decades, researchers have shown an increased interest in the effects of communication and collaboration in virtual teams (Hill & Bartol, 2016; Jarvenpaa & Leidner, 1999; Mesmer-Magnus et al., 2011). Indeed, research has indicated that poor communication behaviors hurt virtual team trust (Jarvenpaa &

Leidner, 1999), collaboration (Hill & Bartol, 2016), and conflict (Montoya-Weiss et al., 2001). Kozlowski and Bell (2003) identified communication, coordination, and cooperation as three key mechanisms which have an essential high impact on virtual team effectiveness.

In traditional face-to-face teams, communication can fail because individuals could receive different messages when listening to the same communication due to different perspectives and biases from the receiver (Salas et al., 2005). Members of traditional teams can use non-verbal cues (e.g., gestures) to better understand each other's messages. However, members of virtual teams are likely to lose inter-relational mechanisms to handle team problems and succeed due to the loss of non-verbal cues, the loss of social information, and cross-cultural misunderstandings (Cramton et al., 2007; Hertel et al., 2005; Montoya-Weiss et al., 2001; Spears & Lea, 1992; Joseph B Walther, 1992).

Several theories, such as media richness theory (Daft & Lengel, 1986), media synchronicity theory (Dennis et al., 1998), task-technology fit perspective (Maruping & Agarwal, 2004), and social presence theory (Short, Williams, & Christie, 1976), cues-filter out theories (Jseph B. Walther, 2011), suggest that communication media differ in their capacity to transmit information, with some communication reducing uncertainty and ambiguity (richer communications) more than others (leaner communication). Based on notions of media richness theory (Daft & Lengel, 1986) and media synchronicity theory (Dennis et al., 1998), Kirkman & Mathieu (2005) proposed a multidimensional definition of virtuality, including the extent to which team members use virtual tools, the amount of informational value provided by such tools, and the synchronicity of their virtual interactions. This definition fundamentally changed the conceptualization of virtuality and studies that have previously only compared face-to-face with virtual teams as dichotomous.

In general, researchers agree that the degree of virtuality can affect team processes (e.g., information sharing), emergent team states (e.g., team trust), and, ultimately, team outcomes (e.g., team performance) (see Gilson, Maynard, Jones Young, Vartiainen, & Hakonen, 2015 for a review). Virtual team research has consistently reported that teams' level of virtuality negatively affects teams' processes and outcomes. For example, in an experimental study using a sample of approximately 52 teams, Peñarroja and colleagues (2013) found that high-virtuality teams (e.g., teams using leaner media rather than video conferencing or face-to-face communications) had lower levels of trust, which, in turn, was positively related to team outcomes. Additionally, in a study using 42 student teams, Jarvenpaa, Shaw, and Staples (2004)

found that effective communication was positively associated with perceived task quality at the end of the three-week course project. Furthermore, in a study of approximately 38 teams, Johnson, Bettenhausen, and Gibbons (2009) found that team members using more technology-mediated communications reported lower affective commitment to their teams. In her seminal study on virtual teams, Cramton found that team virtuality affected their mutual knowledge and collaboration (Cramton, 2001). More specifically, Cramton (2001) found that teams communicating virtually often experienced the challenges of mutual knowledge characterized by failures to (1) communicate and retain contextual information, (2) distribute information equally between team members, (3) communicate and understand relevant information, (4) timelines for accessing information, and (5) interpret the meaning of a team member's silence. Because all these mutual knowledge failures are related to the information shared by the team members, it seems likely that higher virtuality in student teams will hinder team information sharing and performance.

This thesis advances the abovementioned research on virtual collaboration. Overall, this thesis addresses the following research question: *What factors promote effective collaboration in a virtual context?* To comprehensively address this research question, I explore factors across various levels of analysis. First, I begin by examining individual-level factors that enable effective virtual collaboration. In this section, I investigate the relationship between gender and successful virtual collaboration in teams. Then, I analyze team-level factors that facilitate effective virtual collaboration. In this section, I examine how the degree of virtuality negatively affects on-campus student performance and the critical role of virtual communication behaviors in facilitating effective virtual collaboration. Finally, I explore dyadic-level factors that enable effective virtual collaboration. In this section, I build theory on factors that promote effective virtual collaboration in dyads by minimizing the negative impact of time-based unresponsiveness.

### 1.2. Structure of the thesis

This thesis is divided into six chapters that address the main research question. The central part of this thesis is a compendium of three essays (Chapters 2, 3, and 4) which each focuses on a different level of analysis. The *first chapter* is a general introduction to the thesis. The *second chapter* focuses on factors at the individual level that promotes effective virtual collaboration: gender and situational judgment. This chapter draws on the person-environment fit theory (Shin, 2004; Van Vianen, 2018). Using multi-source and multi-wave data, we

theorized and found that women tend to collaborate more effectively in virtual environments. This is because their skills and abilities tend to be better suited to overcome the challenges of virtual collaboration, which require more relationship-building and effective virtual communication. We posit this will occur due to the tendency for females to be more communal and agentic than their male counterparts and that this fits better with the challenges of the virtual work environments. We empirically test these predicted gender differences using a sample of undergraduate student teams and a sample of graduate student teams.

Overall, Chapter 2 findings provide empirical support for the P-E fit theory in virtual environments. Also, we contribute to research on individual differences in virtual environments, which are different from more stable personality traits and cognitive abilities and can be developed with training and used in organizations for selection procedures. We also contribute to the literature on situational judgment and, more specifically, to situational judgment antecedents in virtual environments. This is critical because it highlights the importance of demographic characteristics such as gender in teamwork skills, which has generally been overlooked because researchers in this area are more focused on understanding team-level dynamics. Finally, we contribute to emerging research on gender differences in virtual environments and, more specifically, on self-managed teams. This is important because the existing research has mainly focused on how women may be better leaders in a virtual environment. Our results suggest that women can not only be better virtual leaders but also be better virtual teammates due to their relational orientation, which is crucial to overcoming the challenges of virtual work.

The *third chapter* focuses on factors at the team level that facilitates effective virtual collaboration: team information sharing and virtual communication behaviors. This chapter draws on social interdependence theory (Johnson & Johnson, 1984, 2009; Razmerita et al., 2020) and virtual team research (e.g., Cramton, 2001; Hill & Bartol, 2016; Mesmer-Magnus, DeChurch, Jimenez-Rodriguez, Wildman, & Shuffler, 2011). In this essay, we examine whether on-campus student team virtuality hinders teams' information sharing and, ultimately, team performance. We then explore how virtual communication behaviors may mitigate the detrimental effects of team virtuality. More specifically, we theorize and test whether on-campus student teams with higher degrees of team virtuality perform worse than those with lower levels of team virtuality. This means that worse performance ought to occur in on-campus student teams whose members communicate with each other using a higher (rather

than lower) frequency of virtual tools (e.g., technology-based rather than face-to-face (on-site) communications). Next, we challenge this logic by noting that teams relying on virtual communication behaviors can perform better.

We empirically test these hypotheses using two studies with multi-source and multi-wave samples of on-campus student teams with variability in their level of team virtuality. In this essay, given the pervasive lack of awareness among management educators about the possible detrimental influence of team virtuality on the interactions of these on-campus student teams, we aim to raise awareness about the importance of considering these teams' virtuality and suggest that management educators improve students' performance by presenting effective virtual communication strategies in their courses. We also take an initial step towards identifying and synthesizing virtual communication behaviors that can allow students in on-campus project teams to improve their teamwork. By contributing to understanding effective virtual communication behaviors, we extend the limited empirical research related to the effect of virtual communication behaviors on team performance (e.g., Gibson & Gibbs, 2006; Hill & Bartol, 2016; Jarvenpaa & Leidner, 1999) to more traditional in-person teams such as the on-campus student teams.

The *fourth chapter* focuses on factors at the dyadic level that enable effective virtual collaboration: response-time expectations, forgiveness, and positive interpersonal relationships. This chapter develops theory explaining the antecedents and consequences of perceiving time-based unresponsiveness at work. We define time-based unresponsiveness as the extent to which a task requestor (sender) perceives the receiver as untimely in providing information that fully meets the sender's request. We integrate expectancy violation theory (Burgoon, 1993, 2015; Burgoon et al., 1989; Burgoon & Hale, 1988; Burgoon & Walther, 1990) with insights from forgiveness research (Bies et al., 2016; Fehr et al., 2010) to postulate that the adverse reaction to a task receiver's time delay is preventable if senders expect longer response times and are more forgiving of individuals they regard as unresponsive. Furthermore, we note the greater difficulty of the latter two contingencies when senders feel time urgency and perceive the receiver is time constrained. Finally, we propose the higher difficulty of decreasing negative reactions to perceived time-based unresponsiveness if the culprit is a recurrent offender. If these hypothesized links are experimentally tested in future studies, they have the potential to allow coworkers and colleagues to collaborate successfully and cohesively while experiencing time-based unresponsiveness, which is unavoidable in today's increasingly

virtual workplace. Finally, in the *fifth chapter*, we provide general conclusions and avenues for future research. References are included at the end of each chapter.

### 1.3. Summary of research methods

One of the primary goals for this thesis was to cover different research methodologies (e.g., quantitative methods and theory building), multilevel models (e.g., hierarchical linear modeling and multilevel structural equation modeling), and statistical tools (e.g., SPSS and Mplus). In Chapter 2, we propose an individual-level research question using an undergraduate and a graduate sample and testing it using multilevel structural equation modeling. In Chapter 3, we propose a team-level research question using two undergraduate student samples and tested it using hierarchical linear modeling in SPSS. Finally, in Chapter 4, we propose a theoretical model for a dyadic level phenomenon pervasive in virtual work. Please see Table 1 for details on each essay's research method.

| | **Chapter 2** | **Chapter 3** | **Chapter 4** |
|---|---|---|---|
| **Approach** | Quantitative | Quantitative | Theory Building |
| **Level** | Individual-Level | Team-level | Dyadic-Level |
| **Sample Size** | • Sample 1: 182 individuals in 41 teams<br>• Sample 2: 132 individuals in 34 teams | • Sample 1: 187 individuals, 40 teams<br>• Sample 2: 209 individuals in 49 teams | • NA |
| **Design** | • Survey research (correlational study)<br>• Time lagged<br>• Non-experimental design | • Survey research (correlational study)<br>• Time lagged<br>• Non-experimental design | • NA |
| **Methodology** | • Multilevel SEM (MLR and Bayes) – using SPSS and Mplus | • Survey research (correlational study) – using SPSS, macro-Process | • NA |
| **Measures** | • Multisource (self-report and peer evaluations)<br>• Objective measures | • Multisource (self-report)<br>• Objective measures | • NA |

*Table 1 – Overall Research Methods and Details*

# 2. Gender Differences in Virtual Collaboration Effectiveness

This first essay is focused on an individual-level phenomenon in virtual environments. The main goal was to examine gender differences in virtual environments using multilevel modeling analysis.

## 2.1. Abstract

In recent years, organizations have witnessed a considerable shift toward virtual work, which the COVID-19 pandemic has further accelerated. As a result, many workers work remotely and plan to continue doing so in the future. This trend in virtual work entails collaborating in virtual environments and communicating through technology-mediated communication. These changes in the nature of work emphasize the need to identify the characteristics that enable individuals to perform well in virtual environments. While great emphasis has been devoted to studying virtual team dynamics and performance, far less attention has been paid to understanding the individual characteristics that may contribute to the efficacy of virtual collaboration. In this article, we focus on gender differences in virtual collaboration effectiveness. We hypothesize and find evidence that women tend to be more effective collaborators in virtual environments due to their higher degree of virtual teamwork situational judgment. In the first study, we find the direct influence of gender on team members' virtual collaboration effectiveness. In the second study, we find that virtual teamwork situational judgment mediates the effect of gender (women) on team members' virtual collaboration effectiveness. Overall, our findings provide empirical support for the person-environment fit theory in virtual environments and contribute to research on individual differences in virtual teams and gender differences in new work environments.

## 2.2. Introduction

In recent years, organizations have witnessed a considerable shift toward virtual work, where employees interact through technology-mediated communication (e.g., TMC, e-mail, instant messaging, videoconference) rather than in-person. Due to this tendency, which has been further accelerated by the COVID-19 pandemic (Alexander et al., 2021; Gardner & Matviak, 2020; Gartner, 2021; Microsoft, 2022; Rue, 2020), many organizational teams are either virtual or involve a significant amount of virtual collaboration.

Research suggests that virtual collaboration via TMC creates additional challenges for team members beyond those experienced in face-to-face contexts (for reviews, see Gibson et al., 2014; Gibson & Cohen, 2003; Gilson et al., 2015; Kirkman et al., 2012; Raghuram et al., 2019). These virtual collaboration challenges include, for example, developing and sustaining higher levels of trust (Gibson & Manuel, 2003; Jarvenpaa & Leidner, 1999), sharing information appropriately (Mesmer-Magnus et al., 2011), and developing interpersonal relationships that will provide a common understanding (Hinds & Mortensen, 2005) and identity (for a review, see Gilson, Maynard, Jones Young, Vartiainen, & Hakonen, 2015 and Raghuram, Hill, Gibbs, & Maruping, 2019). Thus, it is critical to understand individual attributes, dyadic and team dynamics that promote more effective collaboration in virtual settings (Hill & Bartol, 2016; Krumm et al., 2016; Krumm & Schulze, 2017; Makarius & Larson, 2017; Schulze & Krumm, 2017).

Virtual team research has primarily focused on the team level, examining team dynamics that influence team performance and paying significantly less attention to individual characteristics that facilitate more effective virtual collaboration (Gilson et al., 2015). According to Gilson and colleagues'(2015) extensive literature review on virtual teams, these individual characteristics have been studied minimally and provide a significant opportunity for future research. In line with this, Makarius and Larson (2017, p.165) noted the need for "a greater focus on the individual worker" to determine who is likely to be a more effective virtual team member.

The scant empirical research that has sought to understand characteristics that enhance individuals' knowledge, skills, and abilities that foster virtual collaboration effectiveness has mainly examined personality and work experience (Hertel et al., 2006; Schulze & Krumm, 2017). Differences between men and women in their virtual collaboration effectiveness have yet to be considered, despite research suggesting that women's tendency to pursue

collaboration and communal goals (for a review, Kossek et al., 2017) better positions them to overcome the aforementioned virtuality-related collaboration challenges (Villamor et al., 2022).

As a result, women tend to have more positive perceptions of virtual communication such as e-mail (Gefen & Straub, 1997; Ledbetter, 2008), instant messaging (Debrand & Johnson, 2008), and videoconferencing (Lowden & Hostetter, 2012). In addition, teams interacting electronically with a higher proportion of women are more cooperative with higher productivity (Song et al., 2015). Women also have an advantage over men in leading globally dispersed teams, resulting in women-led teams exhibiting more shared leadership, cohesion, cooperation, and participative communication (Muethel et al., 2012; Post, 2015). However, unlike this current study, this existing research did not directly assess how gender might influence *individual* effectiveness in virtual environments.

We draw on person-environment (P-E) fit theory as well as virtual team and gender research to examine gender differences in virtual collaboration effectiveness. According to P-E fit theory, individuals function more effectively and, thus, have higher performance levels when there is a match between their characteristics and those of their work environment. We propose that women tend to be more effective than men at collaborating in virtual environments because they are more likely to have the skills and abilities required to overcome the relationship-building and communication challenges created by virtual communication (Brown et al., 2022).

Our study makes three important research contributions. First, it contributes to virtual team research by advancing the understanding of team members' characteristics that influence their virtual collaboration effectiveness beyond personality traits and work experience (Hertel et al., 2006; Makarius & Larson, 2017). We examine the effect of gender in self-managing ad hoc teams where each member's virtual collaboration effectiveness may be particularly critical for the team to perform well because of the lack of a formal leader and hierarchy. Moreover, we follow recent guidance to focus on challenges related to specific facets of virtuality (e.g., TMC, geographic dispersion; Schulze & Krumm, 2017)—namely, we examine gender effects in a context where team members collaborate using TMC, but that does not involve a significant degree of geographic dispersion.

Second, by highlighting a key mechanism through which women gain a virtual-collaboration advantage—virtual teamwork situational judgment (VT-SJ)—our study

contributes to research on situational judgment in virtual environments (for an exception, see Hill & Bartol, 2016). Situational judgment is an individual's awareness of the most successful approaches for dealing with challenges inherent in a particular work context and their ability to use those strategies effectively (Chan, 2006; Christian et al., 2010). Work on situational judgment is extensive but primarily concerned with the judgments and decisions individuals make to respond to situations in more traditional work environments, generally overlooking features of more contemporary work contexts such as virtual environments (Christian et al., 2010; McDaniel et al., 2007). By examining gender as an important predictor of situational judgments, we also extend research on antecedents to VT-SJ, which has mainly focused on factors such as cognitive ability and job experience (Weekley & Ployhart, 2005).

Finally, our study contributes to gender research that identifies work environments that may differentially influence work outcomes for women and men (Kossek et al., 2017). Research suggests that virtuality can be a double-edged sword for women's career equality (Villamor et al., 2022); therefore, it is crucial to understand how virtuality may help improve women's work outcomes. Moreover, given the growth in virtual collaboration in the contemporary workplace, understanding gender differences in virtual settings may help researchers determine how team members might improve their interactions, cooperation, and, ultimately, performance when working virtually. Explicating the behavioral strategies that explain these gender differences in virtual collaboration effectiveness might facilitate research focused on developing and testing effective interventions for improving virtual teamwork.

### 2.3. Theory and hypotheses

Person-environment (P-E) fit theory posits that the compatibility between personal attributes and work environment characteristics predicts individual performance (Schneider et al., 1992). According to P-E fit theory, when personal attributes fit work environments, individuals are more likely to understand their behaviors and the behaviors of others, which facilitates interpersonal relationships and, ultimately, enhances individual performance (for a review, see Van Vianen, 2018). Building on P-E fit theory, Shin (2004) theoretically proposed that some individuals are more likely to excel when working in virtual environments because their attributes and skills allow them to understand specific challenges and demands of virtual work environments. Drawing on this, we focus on how gender differences match those of the characteristics of the virtual environment and lead women to be more (or less) effective collaborators. We propose that women tend to be more likely to be more effective collaborators

in virtual environments because their attributes favor the distinctive challenges of such contexts. We start our theorizing by examining why women's attributes may be suited to overcoming the challenges of virtual environments.

### 2.3.1. Gender differences in virtual collaboration effectiveness

Team research suggests that technology-mediated communications may hinder effective collaboration in virtual environments. These negative impacts are grounded in the fact that when communicating via technology, interactions have fewer social cues (e.g., nonverbal, paraverbal, and contextual cues). This lack of social cues makes it more challenging to develop intimacy (e.g., interpersonal connectedness) and immediacy (e.g., psychological distance) and increases misunderstandings and disagreements among team members (Daft & Lengel, 1986; Sproull & Kiesler, 1986; Walther, 1992). In the absence of nonverbal, paraverbal, and contextual cues (e.g., voice tone, facial expression, or situational information), team members are also more likely to experience ambiguity and uncertainty about the actions and behaviors of one another (Kirkman et al., 2002; Kirkman & Mathieu, 2005), which creates additional challenges for team processes and outcomes (for reviews, see Gilson et al., 2015; Raghuram et al., 2019).

Given these likely negative impacts of virtuality, team members may spend more time building the interpersonal relationships needed to enhance their collaboration. Therefore, it is probable that team members who understand the importance of building interpersonal relationships—with a relational approach—focus on strengthening social interactions among team members may be more effective in virtual environments. A team member with a relational approach, for example, will focus on providing additional support and care for others, improving their personal interactions, and minimizing the negative relational impacts of technology-mediated communication. In general, a team member prioritizing relationship building when working in virtual environments is more likely—than other team members—to enhance cooperation (e.g., Cramton, 2001; Majchrzak et al., 2005), encourage information sharing (Mesmer-Magnus et al., 2011), and maintain and establish trust with others (Breuer et al., 2016; Jarvenpaa et al., 1998, 2004; Jarvenpaa & Leidner, 1999; Makarius & Larson, 2017). Consistent with this, a recent meta-analysis (Brown et al., 2022) found that relational-focused leadership is essential for a virtual team to be more effective. This suggests that individuals who focus on building relationships may be better suited for these virtual environments.

Research on gender differences in social behavior, on the other hand, suggests that women tend to prefer interdependent work, promoting effective team collaboration (Gefen & Straub, 1997; Post, 2015). This is because, compared to men, women tend to have higher relational self-construal. Having a higher relational self-construal means that women tend to view themselves as socially embedded in groups rather than autonomous, leaning toward interdependent rather than independent work (Cross & Madson, 1997; Markus & Kitayama, 1991). This is consistent with research that women's behavior is mainly motivated by group-oriented concerns, such as encouraging the contributions of others, establishing harmonious relationships (Weber et al., 2009), creating intimacy with others, and seeking consensus (Gefen & Straub, 1997).

Women's relational self-construal is essential for effective collaboration in virtual environments since it indicates that they will emphasize interpersonal interactions (Maznevski, 1994; Robert et al., 2018). When working in virtual environments, this emphasis on human relationships makes women more likely to prioritize clear communications, promote shared understanding, and build trust with other team members (Cramton, 2001; Hinds & Bailey, 2003; Majchrzak et al., 2005; Massey et al., 2003; Maznevski & Chudoba, 2000; Montoya-Weiss et al., 2001). Consistent with these arguments, empirical research suggests that due to their team orientation and participative leadership style, women are more likely than men to share their leadership in virtual teams (Muethel et al., 2012). Similarly, Post's (2015) findings suggest that, when leading virtual teams, women tend to improve their teams' cooperative learning and participative communication. These notions are also consistent with role theory's suggestion that gender differences in social behavior are caused (at least to some extent) by the tendency to behave consistently with their social role: Men are considered to be focused on agency-oriented (task completion), preferring independence from others, and women to be focused on community-oriented, choosing interpersonal cooperation and relationship building and maintenance (Eagly & Karau, 1991; Eagly & Wood, 1991; Guadagno & Cialdini, 2002). Taken together, this leads to the following hypothesis:

> *Hypothesis 1:* Women will be more effective collaborators in virtual environments than men.

### 2.3.2. The mediating role of virtual teamwork situational judgment

Situational judgment refers to "individual differences in the general ability to make effective judgments or responses to situations" (Chan, 2006, p.476). Applied to a virtual

environment, virtual teamwork situational judgment (VT-SJ) is the extent to which an individual knows how to successfully handle virtual challenges and their ability to use that knowledge to appropriately respond to those situations (Hill & Bartol, 2016). Given that women tend to naturally behave in ways that are a good fit for the virtual environment, they are likely to have a better sense or judgment of the best way to respond to challenging virtual teamwork situations, resulting in more effective virtual collaboration behaviors.

Research on team-related SJT has shown that team situational judgment is generally associated with team member performance (e.g., Chen et al., 2004; Hirschfeld et al., 2006; Leach et al., 2005; McClough & Rogelberg, 2003; Miller, 2001; Stevens & Campion, 1994, 1999). In a virtual environment, for example, a team member with high VT-SJ will recognize that communicating effectively (Blackburn et al., 2003; Maruping & Agarwal, 2004; Maznevski & Chudoba, 2000), fostering a mutual understanding (e.g., Blackburn et al., 2003; Cramton, 2001; Shin, 2004; Warkentin et al., 1999), and developing trust (Bell & Kozlowski, 2002; Blackburn et al., 2003; Shin, 2004) are crucial to success in virtual work environments. Past research supports the notion that VT-SJ is a significant individual characteristic for successful virtual team member performance (Hill & Bartol, 2016). In their study of 250 team members working in 29 dispersed teams from a large multinational organization, these authors found that under highly empowering team leadership conditions, team members' VT-SJ increased virtual collaboration behaviors and, ultimately, individual team member performance. Considering that our focus is on virtual environments that lack a formal team leader (self-managed teams), where members tend to be more committed to building interdependent work processes and assuming joint accountability for their common goal (e.g., shared leadership) (Carte et al., 2006), it is likely that those team members who tend to have higher levels of VT-SJ would understand the most effective ways to communicate and collaborate, hence becoming more effective.

Additionally, we posit that women tend to have higher levels of VT-SJ than men. Research has shown that women and men tend to differ in their perceptions and use of virtual communication. For instance, women are more likely than males to recognize the value of technology-mediated communications (e.g., e-mail, instant messaging, and video conferencing) and to perceive these interactions more favorably (Boneva & Kraut, 2002; Debrand & Johnson, 2008; Gefen & Straub, 1997; Ledbetter, 2008; Lowden & Hostetter, 2012). Given this tendency toward positive perceptions, women may engage with technology more often than males, enabling them to obtain more experience, knowledge, and a better

awareness of the problems of situations in virtual environments. This is consistent with research indicating that experience is significantly associated with situational judgment, and that situational judgment exhibits slight but significant gender differences that advantage women in other person-focused situations (e.g., service-oriented jobs) (Weekley & Jones, 1999).

Moreover, because women's qualities and skills tend to match the requirements of virtual environments, women will likely have a greater ability to judge situations in virtual environments and be more aware of potential problems. As a result, women will tend to deal with the challenges of virtual environments more effectively than men. Following our reasoning, women, for example, will tend to select the appropriate medium for each task, clarify the meaning of the messages, and provide contextual information to other team members to reduce misunderstandings. Taken together, it follows that VT-SJ will mediate the effect of gender (women) on team member virtual collaboration effectiveness. Based on this reasoning, we hypothesize:

> *Hypothesis 2:* Virtual teamwork situational judgment will mediate the effect of gender on team member virtual collaboration effectiveness, such that women will have higher levels of virtual teamwork situational judgment and, ultimately, higher virtual collaboration effectiveness than men.

### 2.4. Overview of studies

We tested our hypotheses in two studies using two samples from students (undergraduate and graduate) from management courses taught at a large university in the United States. In Study 1, using a time-lagged design, we randomly assigned participants to teams and examined the impact of team member virtual collaboration effectiveness. In Study 2, using a time-lagged design, we measured team members' virtual situational judgment to determine whether it mediated the relationship between team members' gender and their virtual collaboration effectiveness. See Figure 1. In both samples, the teams reported high levels of virtuality (see details below), which made the samples appropriate for testing our hypothesis.

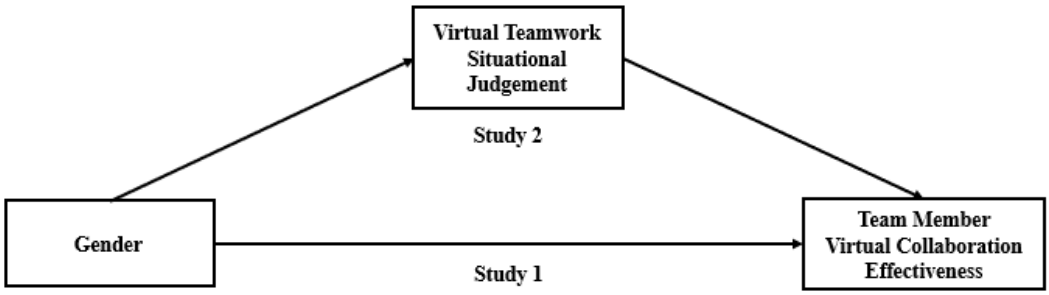



*Figure 1 – Overall Theorized Model*

### 2.4.1. Study 1

#### 2.4.1.1. Sample

We tested Hypothesis 1 with a sample of students from an undergraduate management course taught at a large university in the eastern United States. Students were randomly assigned to self-managing project teams of four to six members at the start of the semester to complete a project comprising 30% of the class grade. Most of the teamwork was completed outside of the class sessions, leaving team members free to decide the extent to which the team would interact virtually versus face-to-face. Data collected as part of the study (and discussed in more detail in the methods section) revealed that the degree of virtual communication in the teams in the sample varied between 40% and 92% (mean = 65.67%, SD = 13.82), with only 15% of teams reporting between 40% and 50% in their degree of virtuality. Thus, the teams engaged in a significant degree of virtual collaboration, making the sample appropriate for testing the hypothesis.

Participation in the study was voluntary, with a response rate of 91% (227 students). Forty-five team members were dropped (19.8%) from the study because an assessment of their virtual collaboration effectiveness by their team members was not available. The final sample for the study was 182 individuals in 41 teams. The sample was 54.4 % female. Participants reported ethnicity of 53.5% White, 22% Asian, 11% Hispanic, 3.3% Black or African American, and 10.4% other. The average age of participants was 20 years old (SD=1.22).

#### 2.4.1.2. Task and procedure

The teams' task resembled a consulting project task whereby teams researched a contemporary issue or practice related to managing human resources, conducting critical analysis, and developing recommendations regarding how organizations might address the

problem or implement the practice in the most effective way. The analysis and recommendations required that the team work interdependently to exchange and integrate ideas. Teams submitted interim deliverables, which required them to collaborate on the project throughout the semester, culminating in a presentation in front of their class section at the end of the semester. We collected survey data in two waves. Early in the semester (Time 1), participants provided demographic data. At the end of the semester, team members assessed their teammates' virtual collaboration effectiveness (when the team project was complete, Time 2).

#### 2.4.1.3. Measures

***Gender.*** Gender was coded as a dummy variable, with women assigned a value of 1 and males assigned a value of 0.

***Team member virtual collaboration effectiveness.*** We assessed team member's virtual collaboration effectiveness by adapting Welbourne and colleagues' (Welbourne et al., 1998) 4-item team-role performance scale to apply to virtual teamwork performance. Participants were asked to rate the virtual collaboration effectiveness of each other member of their team. Specifically, they were asked to rate "this team member's overall effectiveness related to interacting *virtually* with the team (i.e., when communicating using technology rather than face-to-face)." The general instructions to the survey also defined virtual collaboration and made it clear that the survey questions focused on collaborating virtually. Sample items included: my teammate was effective in "aiding the effective flow of information in the team when it is operating virtually" and "responding to the needs of others when working virtually in the team." Peers indicated the extent to which each item described the focal team member using a scale of 1 = does not describe the team member at all to 7 = describes the team member extremely well. Peer ratings have been widely used to assess team members' collaboration effectiveness (Brutus & Donia, 2010; Toegl & Conger, 2003). The measure of agreement among peer ratings produced an average $r_{wg}$ of 0.79 and intraclass correlation coefficients (ICC) of ICC(1) of 0.27 ($F = 2.29$; $p < 0.005$), and an ICC(2) of 0.56. Both the $r_{wg}$ as well as the two intraclass coefficients, ICC(1) and ICC(2), provided evidence of an acceptable level of agreement at the individual level (Bliese, 2000).

***Controls.*** We evaluated numerous variables of theoretical significance based on past team research to rule out alternative explanations for our results. This includes team members' attitudes toward virtual teamwork, perceived work interdependence, team size, team gender

diversity, and the degree of virtuality. We considered attitude toward virtual teamwork as a control because there is evidence showing that attitudes toward collaboration may impact team members' belief in their capacity to be effective in a team, which may affect their performance. We controlled for attitudes toward virtual teamwork (e.g., Thoms, Moore, & Scott, 1996), adapting 3-items from Thoms et al. (1996)'s five-item measure of attitude toward self-managing teams by replacing "self-management teams" with "working online with my team." A sample item from this scale is "I think that working virtually with my team is a good idea." ($\alpha = 0.92$). Finally, we controlled for perceptions of task interdependence—namely, "the extent to which employees perceive that their tasks depend on interaction with others and others' tasks being completed" (Bishop & Scott, 2000, p. 440) because previous research has shown that these perceptions may affect individuals when working in teams. We measured perceptions of task interdependence using Bishop and Scott's (2000) 4-item scale ($\alpha = 0.73$). An example item is "tasks performed by team members are related to one another."

At the team level, we also followed previous research (e.g., Guillaume and Brodbeck, 2014) and controlled for team size, gender diversity, and team degree of virtuality. First, given our interest in virtual collaboration effectiveness, and although the variation of virtually in this sample was between 40% and 92% (mean of 66%), we controlled for the differences in team degree of virtuality to rule out these differences from our analyses. Following the conceptualization of Kirkman and Mathieu (2005) and the approach taken in past studies, we computed the team degree of virtuality as the percent of interaction using non-face-to-face methods (Hill et al., 2014; Maynard et al., 2012). The figures reported had to total 100%. The aggregation statistics for team degree of virtuality were [ICC(1)= 0.14; ICC(2)= 0.43], so we aggregated the individual responses to the team level. Finally, we wanted to rule out team size and gender diversity as alternative explanations because, theoretically, they may impact the effect that gender has on virtual collaboration effectiveness. For example, women in smaller teams or with a greater number of women may be more comfortable collaborating with their teammates than when they are part of bigger teams or teams with a higher proportion of men. Additionally, past research has suggested that team gender diversity may affect team members' performance. We controlled team gender diversity using Blau's index, a typical measurement for team gender diversity, and reached the maximum level when the number of women on the team was the same as the number of men (Guillaume et al., 2014; Harrison & Klein, 2007).

#### 2.4.1.4. Preliminary analysis

First, although our variables of interest were at the individual level, to test our hypothesis, we tested the extent to which there was significant variance at the team level for virtual collaboration effectiveness. ICC(1) value indicated that 19 percent of the variance in team member virtual collaboration effectiveness was between teams and about 81 percent was within teams (also a median $r_{wg}$ = 0.86, and ICC(2) of 0.52). Following Preacher, Zyphur, and Zhang (2010)'s recommendations, due to the nested nature of our data (team members working in teams), we tested our individual-level hypothesis with multilevel structural equation modeling (MSEM) using Mplus 8.7 (Muthén & Muthén, 2007). This methodological approach enables us to partition the individual-level and between-level variances, allowing for simultaneous testing of both influences without contaminating each other. It also allows the simultaneous estimation of all the parameters in the model, resulting in more robust estimates of standard errors that those obtained using hierarchical lineal modelling.

#### 2.4.2.5. Results and discussion

Table 2 provides the means, standard deviations, and correlations of the measures and variables used in the study.

| **a) Individual (Level 1) Variables** | **Mean** | **SD** | **1** | **2** | **3** | **4** |
|---|---|---|---|---|---|---|
| 1. Attitudes toward virtual teamwork | 5.54 | 1.23 | - | | | |
| 2. Perceived task interdependence | 6.20 | 0.72 | 0.38** | - | | |
| 3. Gender[a] | 0.54 | 0.50 | -0.01 | 0.14 | - | |
| 4. Team member's virtual collaboration effectiveness | 6.11 | 0.91 | 0.02 | -0.03 | 0.23** | - |
| **b) Team-Level (Level 2) Variables** | **Mean** | **SD** | **1** | **2** | **3** | **4** |
| 1. Team size | 5.25 | 0.74 | - | | | |
| 2. Team gender diversity | 0.43 | 0.09 | 0.30** | - | | |
| 3. Team degree of virtuality | 0.66 | 0.14 | -0.16* | 0.02 | - | |

*Note. n = 182 individuals.*
*[a] Men=0 and Women=1*
*** p < .01; * p < .05*

*Table 2 – Descriptive Statistics and Correlations (Study 1)*

Hypothesis 1 suggests that women are significantly more effective collaborators when working in virtual environments than their male counterparts. We began our analysis by testing the multilevel model fit. The model provided a good fit to the data with $\chi2(39) = 526.64$, $p < 0.01$, Tucker–Lewis index (TLI) = 0.96, comparative fit index (CFI) = 0.97, root mean square error of approximation (RMSEA) = 0.05, standardized root-mean-square residual $SRMR_{within} = .05$ and $SRMR_{between} = 0.01$. The chi-square difference tests (the change in deviance test based on loglikelihood values and scaling correction factors obtained with MLR) comparing differences between the theoretical multilevel model and the model without controls was statistically significant with $\Delta\chi2\ (27) = 2866.29$, $p < 0.001$, indicating the model structure with controls is significantly better than the model without controls. Also, the chi-square difference tests (the change in deviance test based on loglikelihood values and scaling correction factors obtained with MLR) comparing differences between the theoretical multilevel model and the multilevel unconditional model (only endogenous variable) was statistically significant with $\Delta\chi2\ (1) = 126.50$, $p < 0.001$, indicating the model structure is significantly better than the unconditional model. The relationship between gender was significant and was positively associated with team member's virtual collaboration effectiveness ($B= 0.48$, $p<0.001$), suggesting that women tend to have higher levels of virtual collaboration effectiveness than men (see Figure 2). Therefore, hypothesis 1 was supported. Table 3 summarizes the results from MSEM analyses.

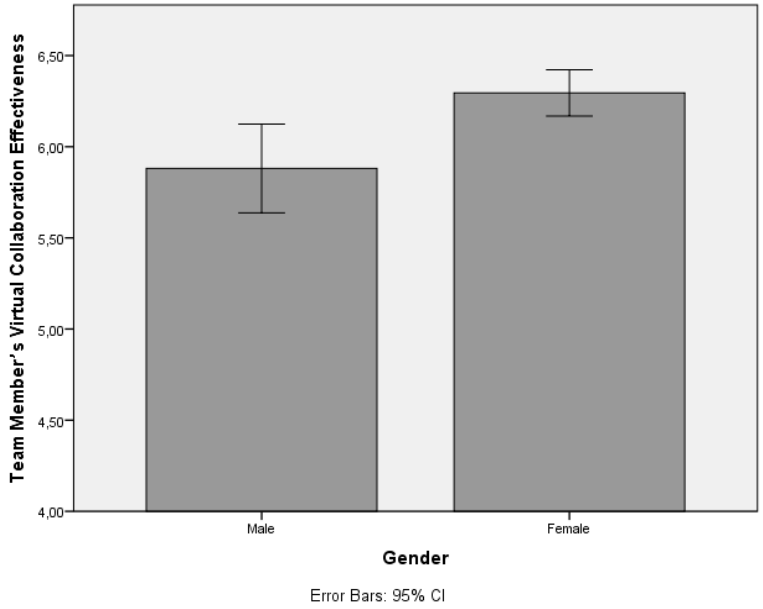



*Figure 2 – Team Member Virtual Collaboration Effectiveness (Study 1)*

| Variables | B | SE | LL 95%CI | UL 95%CI |
|---|---|---|---|---|
| *Level 1 predictors* | | | | |
| Gender [a] | 0.48*** | 0.13 | 0.25 | 0.76 |
| Perceived task interdependence | -0.03 | 0.17 | -0.36 | 0.30 |
| Attitudes toward virtual teams | -0.13 | 0.09 | -0.29 | 0.04 |
| *Level 2 predictors* | | | | |
| Team size | 0.16 | 0.13 | -0.09 | 0.42 |
| Team gender diversity | -1.34* | 0.61 | -2.54 | -0.15 |
| Team degree of virtuality | 0.43 | 0.68 | -0.90 | 1.77 |

*Note. n1*=182 individuals; n2= 41 teams.
[a] *Men=0 and Women=1*
Two-tailed tests. *** $p < .001$; ** $p < .01$; * $p < .5$

*Table 3 – Team Member Virtual Collaboration Effectiveness (Study 1)*

Study 1 shows that gender was significantly and positively associated with team member virtual collaboration effectiveness while controlling for age and attitudes at the individual level, team diversity, and team size at the team level. We conducted a second study to test VT-SJ as a mediator of this relationship (Hypothesis 2).

### 2.4.2. Study 2

The main limitation of Study 1 was the absence of possible mediating mechanisms explaining *why* there was a gender difference in virtual collaboration effectiveness. Thus, the goal of Study 2 was to test virtual teamwork situational judgment as a mediating mechanism between gender and team member virtual collaboration effectiveness. We also included additional controls to rule out alternative explanations for our results (e.g., individual's experience with teams and cognitive ability)**.**

#### 2.4.2.1. Sample

We tested Hypothesis 2 with a sample of students from two MBA classes at the same university as in Study 1. In both classes, students were randomly assigned to self-managing project teams of four to five members at the start of the semester to complete a project comprising 33% of the class grade. One of the classes was taught entirely online, so all team members' collaboration was virtual. The second class was conducted on-campus. As in study 1, teams completed most of their work outside class sessions and were free to decide to what

extent they would interact virtually versus face-to-face. To follow the same approach as in Study 1, we only included teams that operated at least 40% virtually. Thus, across both classes, teams' degree of virtual communication ranged between 40% and 100%, which was appropriate for testing the study hypotheses.

The data collected for the study was part of a class activity in which all 148 team members participated. Sixteen team members (10.8%) were dropped from the data used for the study because they were missing an assessment of their virtual collaboration effectiveness by their teammates. The final sample was 118 individuals clustered in 30 teams. The sample was 56% female, with ethnicity of 56.1% White, 14.4% Asian, 6.8% Hispanic, 13.6% African American, and 9.1% other. The average age of participants was 31.78 years old (SD=7.178).

#### 2.4.2.2. Task and procedure

The task for teams in the online class was a research project that lasted the entire semester and resembled the task in Study 1. Students conducted research and analyzed a contemporary business issue relevant to their class topic and prepared a presentation and report. In the second class, students completed a six-week strategic decision-making simulation that involved detailed research, analysis, and planning to inform their strategic plan. The teams also produced a comprehensive report with a summary of their research and decision-making, plus an analysis of the results. We collected survey data in two waves for teams in both classes. At the start of the project (Time 1), participants provided demographic data and completed the virtual teamwork situational judgment test. At the end of the semester, when the team project was complete (Time 2), team members assessed their teammates' virtual collaboration effectiveness. As part of the class activity, students received feedback on their virtual collaboration effectiveness once the study was over and listened to a presentation about effective virtual collaboration strategies.

#### 2.4.2.3. Measures

***Gender*.** As in study 1, gender was coded as a dummy variable, with women assigned a value of 1 and males assigned a value of 0.

***Virtual teamwork situational judgment.*** We examined participants' situational judgment in virtual teaming (VT-SJ) using a 30-item measurement adapted from Hill and Bartol's (2016) VT-SJ. Items were adapted because our focus was not on working across cultures (we had students from the same university). Thus, we did not include the items related

to working across differences and cultures that were not focused exclusively on working in virtual environments. Instead, we focused on those related to how members use technology to collaborate (i.e., virtual communication). The VT-SJ assesses team members' judgment regarding the best approaches to communicating, collaborating, building trust, and self-managing in a virtual context. More precisely, the questions detailed hypothetical scenarios, including virtual cooperation. Following the successful approach used in several studies involving situational judgment tests (Sorrel et al., 2016; Weekley & Ployhart, 2005), we scored each question as one of the respondents selected the best response option given the circumstances described; otherwise, the respondent received a score of 0 (e.g., Lievens et al., 2005).

***Team member virtual collaboration effectiveness.*** We examined team member virtual collaboration effectiveness using the same measurement as in Study 1 (Welbourne et al., 1998). Likewise, we computed virtual collaboration effectiveness for each team member by aggregating the mean ratings from teammates who assessed that focal student. The measure of agreement among peer ratings for each team member produced an average $r_{wg}$ of 0.80, an ICC(1) of 0.38 ($F= 2.69$; $p < .001$), and an ICC(2) of 0.63. Both the rwg as well as the two intraclass coefficients, ICC(1) and ICC(2), provided evidence of an acceptable level of agreement at the individual level (Bliese, 2000).

***Controls*.** As in study 1, we explored several variables of theoretical relevance to rule out alternative explanations for our results, such as attitudes toward virtual teamwork ($\alpha = 0.87$) and perceived task interdependence ($\alpha = 0.87$) at the individual level and team size, team gender diversity (Blau index), and team degree of virtuality at the team level. Following Study 1, although the variation of virtually in this sample was between 40% and 100% (mean of 74%), we controlled for the differences in team degree of virtuality to rule out these differences from our analyses. The aggregation statistics for team degree of virtuality were acceptable [ICC(1) = 0.57; ICC(2) = 0.72], so we aggregated the individual responses to the team level. In addition, since the focus of this second sample was on virtual teamwork situational judgment, and previous research indicates that experience (Clevenger et al., 2001) and cognitive ability (McDaniel et al., 2001) are generally correlated with situational judgment and performance, we also explored other variables that may influence participants' situational judgment (Weekley & Jones, 1999; Weekley & Ployhart, 2005). These were team members' experience working on teams ($\alpha = 0.86$) and cognitive ability. To control for cognitive ability, we used

students' grade point averages (GPA) assessed on a scale ranging from 1 to 4 (e.g., Guillaume et al., 2014).

#### 2.4.2.4. Preliminary analysis

As in Study 1, we begin by testing the extent to which there was significant variance at the team level for team member virtual collaboration effectiveness. ICC(1) value indicated that 25 percent of the variance in team member virtual collaboration effectiveness was between teams (also a median $r_{wg}$ = 0.90 and ICC(2) of 0.57). We thus proceeded to perform a multilevel analysis to isolate the individual-level effect while accounting for the variability corresponding to the team-level impacts. Table 4 provides the means, standard deviations, and correlations of the measures and variables used in the study.

#### 2.4.2.5. Results and discussion

To test our mediation, we followed Preacher, Zyphur, and Zhang's (2010) multilevel structural equation modeling (MSEM) approach using Mplus 8.7 statistical software package (Muthén & Muthén, 2007). Because all the variables of interest were measured at the individual level, but there was 22% of variance accounted to the team, we performed Preacher et al. (2010), 1-1-1 with fixed slopes (Gender->VT-SJ->Team Member Virtual Collaboration Effectiveness). We also followed Yuan and MacKinnon's (2009) and González-Romá and Hernández's (2022) recommendations to use Bayes estimation for small sample sizes. According to Yuan and MacKinnon (2009, p.301), an advantage of Bayesian mediation analysis is "the ability to construct credible intervals for indirect effects for simple and complex mediation models in a straightforward manner." Also, Bayesian estimations "do not impose restrictive normality assumptions on sampling distributions of estimates and do not rely on large sample approximations [...]. This property makes the Bayesian approach especially appealing for studies with small samples." (p. 301). Simulation studies have shown that Bayesian methods that use Markov Chain Monte Carlo (MCMC) algorithms produce more precise estimates than Maximum Likelihood estimators (Depaoli & Clifton, 2015; van de Schoot et al., 2017; Wang & Preacher, 2015; Zitzmann et al., 2015, 2016). Recommendations by Kruschke, Aguinis, and Joo (2012), Zyphur & Oswald (2015) and its increasing use in organizational studies also support this view (e.g., Chen, 2005; Chen et al., 2011; Frieder et al., 2019; Klasmeier and Rowold, 2020; Mell et al., 2019).

| a) Individual-Level Variables | Mean | SD | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|---|
| 1. Attitude towards virtual teams | 5.43 | 1.18 | - | | | | | | |
| 2. Perceived task interdependence | 6.22 | 0.95 | 0.34** | - | | | | | |
| 3. Experience in teams | 5.64 | 1.03 | 0.25* | 0.07 | - | | | | |
| 4. Cognitive ability | 3.66 | 0.29 | -0.01 | 0.09 | -0.07 | - | | | |
| 5 Gender | 0.57 | 0.50 | 0.23 | 0.12 | 0.03 | 0.21* | - | | |
| 6. Team member's virtual situational judgement | 19.98 | 4.87 | 0.15 | 0.11 | 0.09 | 0.14 | 0.19* | - | |
| 7. Team member's virtual collaboration effectiveness | 5.90 | 1.11 | 0.07 | -0.06 | 0.19* | 0.09 | -0.08 | 0.27** | - |
| **b) Team-Level Variables** | **Mean** | **SD** | **1** | **2** | **3** | **5** | **6** | **7** | **8** |
| 1. Team size | 4.17 | 0.83 | - | | | | | | |
| 2. Team gender diversity | 0.35 | 0.18 | 0.32** | - | | | | | |
| 3. Team degree of virtuality | 0.77 | 0.20 | -0.27* | -0.22** | – | | | | |

*Note. n = 118 individuals.*

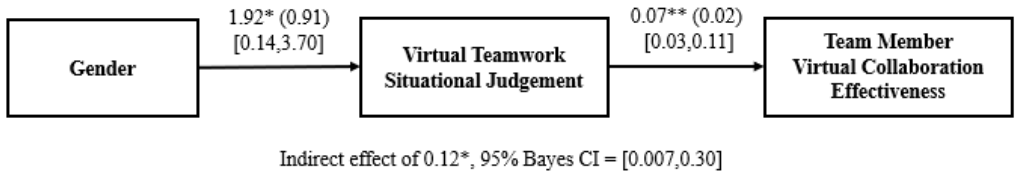
[a] *Men=0 and Women=1*

** $p < .01$

* $p < .05$

*Table 4 – Descriptive Statistics and Correlations (Study 2)*

In Hypothesis 2, we predicted that gender would positively affect team performance via a virtual teamwork situational judgment. In line with our prediction, we found that the indirect effect of gender on team member's virtual collaboration effectiveness via VT-SJ was significant at the individual level (indirect effect=0.12, 95% Bayes CrI = [0.007, 0.30]) with an indirect effect of gender on team member virtual collaboration effectiveness via VT-SJ at the team level that was, as expected, non-significant (indirect effect=0.04, 95% Bayes CI = [-2.53, 4.16]). See Table 5 and Figure 3. Additionally, we verified Bayesian model fit and MCMC convergence using the posterior predictive checking (PPC), potential scale reduction (PSR), trace plot, and degree of autocorrelation, as recommended by van de Schoot et al. (2017) and Kaplan and Depaoli (2012). PPC is a comparison of the fit statistics (based on a likelihood-ratio $\chi 2$ test of model-implied data against observed data. Misspecification of the model might vary in fit statistics (Muthén & Asparouhov, 2012). A positive predictive p-value (PPP) is calculated when the model fit of the simulated data surpasses the model fit of the observed data, with values less than 0.05 indicating a poor fit model. We obtained a PPP of 0.55, indicating a good fit. Additionally, the Bayesian posterior predictive checking should contain zero using Chi-Square's 95% confidence interval for the difference between the observed and the replicated Chi-Square values. We obtained a 96% CI of (-20.66, 21.49) (for details, see, Muthén and Asparouhov, 2012, 2011, for a recent example, see Klasmeier and Rowold, 2020). Following similar research by Klasmeier and Rowold (2020) and Rosen and colleagues (2019), we used uninformative prior distributions (Mplus defaults priors) for our model estimation (for details, see Yuan & MacKinnon, 2009; Zyphur & Oswald, 2015). Additionally, as recommended by Wang and Preacher (2015), we performed the analysis with vague priors and obtained the same results.




*Notes:* 118 individuals; Level 2: 30 teams. Multilevel path analysis was conducted in Mplus 8.7. For clarity, only hypothesized paths are pictured. The control variables are not pictured. Full results are presented in Table 4.

*Figure 3 – Summary of Mediation Model Results (Study 2)*

| | Team Member's Virtual Situational Judgement | | | | Team Member's Virtual Collaboration Effectiveness | | | |
|---|---|---|---|---|---|---|---|---|
| | ***B*** | ***SD*** | ***95% CI*** | | ***B*** | ***SD*** | ***95% CI*** | |
| *Individual-Level* | | | | | | | | |
| Experience in teams | 0.53 | 0.34 | -0.09 | 1.19 | 0.18 | 0.10 | -0.02 | 0.38 |
| Cognitive ability | 0.01 | 0.01 | -0.01 | 0.04 | 0.003 | 0.003 | -0.003 | 0.01 |
| Gender | 1.92* | 0.91 | 0.14 | 3.70 | -0.31 | 0.19 | 0.70 | 0.07 |
| Team member's virtual situational judgement | | | | | 0.07** | 0.02 | 0.03 | 0.11 |
| *Team-Level* | | | | | | | | |
| Virtual situational judgement | | | | | 0.04 | 1.61 | -2.54 | 4.16 |
| Team size | | | | | -0.38 | 0.18 | -0.62 | 0.06 |
| Team gender diversity | | | | | -0.72 | 0.81 | -2.33 | 0.90 |
| Degree of virtuality | | | | | -0.29 | 0.70 | -1.65 | 1.14 |
| **Indirect effect (individual-level)** | | | | | Effect | SE | LCrI | UCrI |
| | | | | | 0.12* | 0.07 | 0.007 | 0.30 |

*Note:* 118 individuals clustered in 30 teams. All t tests are one-tailed. LCI and HCI = lower and higher bounds respectively of 95% Bayesian credibility intervals (95% CrI).

*** $p < .001$

** $p < .01$

* $p < .05$

*Table 5 – Results of Multilevel Mediation Analysis (Study 2)*

Our results suggest that VT-SJ mediates the relationship between gender and team members' virtual collaboration effectiveness: women have higher VT-SJ levels that, in turn, allow them to be more effective collaborators in virtual environments. These notions are consistent with findings suggesting that women may have an advantage when leading virtual teams because they tend to prefer team-oriented and participatory leadership styles and share more of their leadership than their male counterparts (Gardiner & Tiggemann, 1999; Muethel et al., 2012; Post, 2015). They are also in line with a limited number of experimental studies indicating that teams using technology-mediated communication perform better with a higher proportion of women because women tend to encourage cooperation among team members (Song & Jung, 2015) and achieve greater levels of team satisfaction due to their more cooperative communication styles (Savicki et al., 2002).

## 2.5. General Discussion

Drawing on insights from person-environment fit theory, this paper explored how women and men differ in their collaboration effectiveness in virtual environments through increased levels of virtual teamwork situational judgment. Across two studies, we found support for our hypotheses that women tend to have higher virtual teamwork situational judgment levels, leading them to be more effective collaborators in virtual environments. Specifically, Study 1 showed that women tend to be more effective collaborators in virtual environments than men. In Study 2, we showed that situational judgment of women's virtual teamwork is a critical mediating mechanism between gender differences and team members' virtual collaboration effectiveness.

### 2.5.1. Theoretical implications

Our study has several theoretical and practical implications. First, we contribute to the limited research on virtual teams focused on the individual level and answer the call for a greater understanding of the effects of *team member differences* in virtual environments (Kirkman et al., 2012; Makarius & Larson, 2017). Our results go beyond the usual emphasis on personality traits and cognitive ability to examine gender differences in collaboration behavior in virtual environments. Moreover, by investigating the match between individuals' qualities and the team's working environment (e.g., virtuality), we expand the study on P-E fit in teams (Van Vianen, 2018). Research on P-E fit in teams has focused mostly on person-team fit or the compatibility between an individual's attributes and the attributes of other team members. As Mathieu and colleagues (2008) emphasized, the environment in which a team functions is essential to understanding team processes and outcomes. Because virtuality is a characteristic of many collaboration interactions today, it is crucial to comprehend how individual variations influence individual results in teams with such characteristics and not only how individuals' qualities match one another.

Second, our findings contribute to the literature on situational judgment and, more specifically, situational judgment in virtual environments. The limited empirical research on situational judgment in virtual contexts (Hill & Bartol, 2016) has not examined any antecedents (e.g., gender) to virtual teamwork situational judgment. Also, it does not provide evidence of a direct effect of VT-SJ on team member virtual collaboration. Although Hill and Bartol (2016) expected a positive relationship between VT-SJ and team member virtual collaboration, they found that empowering leadership moderated this positive effect such that the positive

relationships between VT-SJ and team member virtual collaboration existed only under situations of highly empowered leadership. In this research, we show that in virtual environments that do not have a formal leader (e.g., self-managed teams), virtual teamwork situational judgment has a direct positive effect on team member virtual collaboration effectiveness even without empowering leadership. One potential reason for this finding is that power is divided equally in virtual environments without formal leadership. Hence, team members are more likely to share their leadership and feel more accountable for the team's final goal, allowing the direct effect to emerge. This is consistent with Muethel et al.'s (2012) findings that when there are higher proportions of women in virtual teams, they tend to share their leadership more. Accordingly, our study highlights the essential role of demographic factors (e.g., gender) in understanding team members' skills and abilities that are key to effective collaborators in virtual environments.

Third, our findings contribute to the emerging theory and research on *gender differences* in virtual environments. Research on gender differences in virtual teams has primarily focused on gender differences in leadership (e.g., Muethel et al., 2012; Post, 2015) or leadership emergence (Carte et al., 2006), paying significantly less attention to gender differences in their collaboration effectiveness as virtual team members. Our findings highlight that women not only have an advantage as leaders, as previous results have shown (Muethel et al., 2012; Post, 2015) but also tend to be more effective team members in virtual teams because they have better judgment about the challenges of virtual environments. Additionally, we provide empirical evidence of the mechanisms through which gender differences may affect collaboration effectiveness in virtual environments—namely, virtual situational judgment. More broadly, by focusing on individual effectiveness in collaboration in virtual environments without a formal leader, our study contributes to the growing literature on gender research in self-managed teams that has focused on gender effects on leadership emergence (Lanaj & Hollenbeck, 2015; Schlamp et al., 2021) at the individual level and gender diversity effects on team performance at the team level (Li et al., 2021).

### 2.5.2. Practical implications

Our findings also have important practical implications. First, our results provide virtual team leaders with helpful insights into the impact of their team's gender composition and how it may affect the effectiveness of their virtual collaboration. Given that workers of all genders may be educated to build VT-SJ to collaborate more effectively virtually, virtual team

leaders should give training and support as needed (Blackburn et al., 2003; Kirkman et al., 2002; Makarius & Larson, 2017; Schulze et al., 2017; Schulze & Krumm, 2017). When conflicts arrive, for example, employees with higher virtual teamwork situational judgment may facilitate or advise strategies for conflict resolution that may help the team overcome these misunderstandings more effectively.

Second, our findings imply that organizations using virtual and hybrid environments, especially those employing self-managing teams, should engage in developing VT-SJ. In virtual environments without formal leaders, team members may lack the leader's guidance and the contextual cues that could allow for a better understanding of each other's distinctive situations, and conflicts may escalate rapidly. As noted by Stevens and Campion (1994, 1999), team-related skills and abilities that differ from personality traits and cognitive ability can be developed with training. This emphasizes the potential impact of developing interventions (e.g., corporate training) designed to train team members to develop better knowledge and judgment over the situations and challenges they encounter in virtual environments.

Finally, many diversity and inclusion organizational programs focus on hiring and promoting women in the workplace. Research also suggests that virtual environments may be both a hindrance and an advantage for women in the workplace (Villamor et al., 2022). Our findings suggest that virtual and hybrid teams could benefit from women's relational approaches to teamwork at the individual level. Thus, organizations and leaders should empower and encourage women to participate in virtual work environments, which might help women advance their careers and reduce or overcome some barriers in the workplace.

### 2.5.3. Limitations and future research

Despite these theoretical contributions, our study has some limitations and interesting future research directions. First, both of our samples are student teams. However, prior research has highlighted the advantages of using student team samples, such as teams doing the same task or collecting data at various time points (e.g., Balkundi et al., 2019; Breugst et al., 2018; Lanaj & Hollenbeck, 2015; Marrone et al., 2007). Interestingly, a recent meta-analysis by Purvanova and Kenda (2021) showed that longitudinal designs utilizing student samples (such as those used in our research) provide equivalent outcomes to those using organizational teams. However, although student teams may closely resemble work teams and research suggests that many student samples' results may generalize to organizational teams (Highhouse & Gillespie, 2009; Purvanova & Kenda, 2021), we recommend future work using virtual environments in

organizations. We believe such work would make our results more generalizable across situations and help discover some boundary conditions.

Second, we acknowledge that it would be preferable to have bigger sample sizes. However, as noted above, our samples resemble others used in research examining individual-level effects in teams (e.g., Lanaj & Hollenbeck, 2015; Marrone et al., 2007) and in virtual team teams (e.g., Hill & Bartol, 2016; Jarvenpaa et al., 1998; Kirkman et al., 2004; Massey et al., 2003). This is because, although students are organized in teams, our variables of interest all pertain to the individual level. In addition, in Study 2 (with the smaller sample size), we also applied Bayes estimation, which is highly recommended for small samples (González-Romá & Hernández, 2022), and followed Yuan and MacKinnon's (2009) recommendations for Bayesian mediation analysis. Bayesian estimations have several advantages in organizational studies (for a review, see Kruschke et al., 2012) and are increasingly used in management science (Chen et al., 2011; Frieder et al., 2019; Sawyer et al., 2022).

Third, teams in our sample were not entirely virtual but hybrid, with team members combining in-person and virtual communications. Therefore, it is possible that students rated virtual collaboration effectiveness not only based on virtual collaboration but also on the non-virtual collaboration that occurred in the team. To overcome this issue, we asked participants to focus on the virtuality aspect of collaboration when assessing their teammates. Additionally, we found support for VT-SJ as a mediating mechanism, and this variable specifically focuses on virtual teamwork. We encourage scholars to extend our predictions by examining these effects in the context of entirely virtual teams and explore any differences between fully virtual and hybrid teams.

Furthermore, person-environment fit research mainly focuses on static evaluations of fit (for an exception, see Jansen & Shipp, 2019). Because our focus is on characteristics and abilities that team members may learn and develop over time and the challenges of virtual environment also evolve due to new technologies, an individual P-E fit may vary. Therefore, future research with longitudinal designs is needed to examine how women-virtuality fit changes over time. This could be done, for example, by measuring virtual situational judgment and various individual-level outcomes at different points in time, before and after a virtual teamwork training, or with and without virtual teamwork experience (e.g., Boon & Biron, 2016; Jansen & Shipp, 2019; Shipp & Jansen, 2011).

Finally, because research suggests that in highly collectivistic cultures, gender diversity in teams is negatively associated with team performance (Schneid et al., 2015), future research may consider how cultural contexts might enhance, decrease, or equalize gender differences in virtual environments. Finally, acknowledging that gender is not a binary construct (Johnson & Repta, 2005; Shan et al., 2019), we would want to conclude by emphasizing the need for future research to examine more nuanced variations in gender and their consequences on individual, team, and organizational outcomes. Given that virtual work allows employees from different cultures and genders to collaborate, we see our research as an opportunity to explore and recognize the importance of these differences in the new virtual and hybrid workplace contexts.

## 2.6. Conclusion

We draw on the person-environment fit theory to show that women tend to collaborate more effectively in virtual environments because their attributes and skills match the demands of virtual teamwork. First, we demonstrate that gender directly influences team member virtual collaboration effectiveness, with women being more effective collaborators in virtual environments than men. Then, we provide evidence suggesting that women tend to exhibit significantly higher virtual teamwork situational judgment levels than men, making them more effective collaborators in virtual environments. We hope that the findings of this study will create greater awareness regarding gender differences in the virtual context and shed light on the importance of developing the virtual situational judgment needed for the challenges of the modern workplace.

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# 3. The Impact of Team Virtuality on The Performance of On-Campus Student Teams

After investigating a critical individual-level phenomenon in virtual environments, this second essay is focused on the consequences of the degree of virtuality on the performance of on-campus student teams and how effective virtual communication can compensate for such detrimental effects.

The main goal of this essay is to make management educators aware of how team virtuality affects traditional on-campus student teams and how important it is to teach students successful virtual communication behaviors for their management course's teamwork.

## 3.1. Abstract

Although evidence suggests that the degree of virtuality should be regarded as a characteristic of all teams (whether virtual, hybrid or more conventional in-person teams), management educators rarely acknowledge that their on-campus student teams are affected by their degree of virtuality. Consequently, there is a dearth of information regarding the possible detrimental impact of team virtuality on the interactions of student teams and how to improve these virtual interactions. The primary objective of this paper is to raise awareness among management educators regarding the extent to which their "traditional" on-campus student teams interact virtually, the negative impact of team virtuality on team performance, and the practical steps that can be taken to help these teams overcome this negative impact. To accomplish this goal, we use two studies. In Study 1, our findings indicate that team virtuality affects student team performance. In Study 2, our findings indicate that team virtuality negatively impacts team performance via team information sharing and that team virtual communication behaviors can contribute to team performance. Finally, we discuss practical implications for assisting management educators in enhancing the performance of their student teams by improving the virtual communication behaviors that occur in these teams.

## 3.2. Introduction

Organizations are increasingly implementing teams to drive flexibility and innovation (Kozlowski & Bell, 2013). In response, management educators frequently assign their students to collaborate in project teams to develop their course work in ways that resemble how they will work in the future (Bacon et al., 1999; Baldwin et al., 1997; Chen et al., 2004; Graen et al., 2006; Hansen, 2006; Jiang et al., 2021; Kalliath & Laiken, 2006; Kidder & Bowes-Sperry, 2012; Pastor & Baruffaldi, 2021; Rafferty, 2013; Wildman et al., 2021). Following a collaborative learning approach (McAlpine, 2000), students in these teams work interdependently on tasks that resemble those completed by teams in the workplace and require significant interaction between team members outside the classroom. The increasing use of digital technologies and team member's conflicting schedule demands often makes frequent in-person meetings challenging; therefore, today's student teams may rely to a large degree on virtual communication, that is, technology-mediated communication (e.g., phone, e-mail, text, social media, online meeting software) rather than face-to-face (FtF). Given research showing that team virtuality can create challenges to effective team dynamics, it is important to understand how the degree of virtual communication (hereafter referred to as team virtuality) in *on-campus student teams* influences team functioning and performance.

However, management educators are likely to overlook the potential for team virtuality to harm the performance of on-campus student teams because they view them as more "traditional" teams than teams in online classes that are entirely virtual. Consequently, they may fail to provide their on-campus student teams with guidance on effective virtual communication behaviors that help mitigate the potentially detrimental effect of team virtuality on team performance. Thus, the primary purpose of our paper is to raise awareness among management educators (and those in other disciplines who include team projects as a significant component of their course) about the degree to which their "traditional" on-campus student teams interact virtually, the negative effect of team virtuality on team performance, and practical steps for helping these teams overcome this negative impact.

To accomplish this goal, we draw on social interdependence theory (D. W. Johnson & Johnson, 1984, 2009; Razmerita et al., 2020) and virtual team research (e.g., Cramton, 2001; Hill & Bartol, 2016; Mesmer-Magnus, DeChurch, Jimenez-Rodriguez, Wildman, & Shuffler, 2011). We address three research questions using two studies of undergraduate student teams in on-campus courses. In the first study, we examine how (a) team virtuality affects on-campus

student team performance. In the second study, we examine the extent to which (b) team virtuality negatively impacts team information sharing and, ultimately, team performance; and, finally, the extent to which (c) team virtual communication behaviors mitigate this indirect effect of team virtuality on team performance through team information sharing. We focus on team information sharing because it is a critical team process for team members to integrate their knowledge and expertise to accomplish the team's mutual goal, nevertheless, the difficulties of virtual communication may hinder this information sharing (Mesmer-Magnus et al., 2011; Mesmer-Magnus & DeChurch, 2009).

Our focus on student teams in on-campus courses differs from existing research on virtual teams in two important ways. First, research has primarily focused on virtual team dynamics and performance in organizational virtual teams (Gibbs et al., 2017). Student teams differ from organizational teams in that they are usually ad hoc teams (e.g., self-managed teams) created for short-term projects with flat organizational structures and no defined leader. As a result, student team members have far less time to develop effective team interactions. Additionally, because they are less likely to work together again in the future, team members may be considerably less concerned with forming favorable impressions or establishing a status that would benefit them in the future. Thus, team virtuality is likely to be more detrimental to the dynamics of student teams.

Second, the limited research on virtual student teams has focused on geographically dispersed teams in online courses (Brad Crisp & Jarvenpaa, 2013; Cramton, 2001; Erez et al., 2013; Jarvenpaa et al., 2004; Jarvenpaa & Leidner, 1999; W. H. A. Johnson et al., 2021; Montoya-Weiss et al., 2001; Piccoli & Ives, 2003; Taras et al., 2013). These teams will likely face additional challenges from being geographically dispersed (e.g., temporal coordination between team members in different time zones) and no opportunity to meet FtF. Thus, existing research lacks insights into the impact of team virtuality in teams in the same physical location but communicate virtually to some (or a significant) degree.

Neglecting the effects of a team's degree of virtuality in on-campus student teams is unfortunate, especially given the critical need for management educators to prepare students for today's virtual work contexts. As noted by, Makarius and Larson (2017, p.159), a "more organic type of virtual work is quickly becoming the norm for many employees," whereby virtual interactions occur outside formal virtual work arrangements such as virtual/remote/hybrid teamwork and telecommuting. This suggests more attention by

management educators on helping students understand the impact of virtuality in teams that might not be viewed as virtual teams because they are *hybrid teams*—combining some degree of virtual and face-to-face interactions (Fiol & O'Connor, 2005). This is not only a growing phenomenon among student teams but also organizational teams (Wildman et al., 2021), due partly to the COVID-19 pandemic, which forced many employees to work virtually. As a result, studies predict that post-pandemic employee expectations of combining in-person with virtual work will grow (Alexander et al., 2021; Gardner & Matviak, 2020; Gartner, 2021; Microsoft, 2022; Rue, 2020). Therefore, developing management students toward effective teamwork in hybrid team environments is an important goal. We close with practical implications for helping management educators enhance the performance of their on-campus student teams by improving the virtual communication that occurs in these teams.

### 3.3. Theoretical foundation

The cooperative learning approach used by management educators when using project teams is based on social interdependence (SI) theory (Johnson & Johnson, 2009), which focuses on how performance outcomes are differentially affected by different peer interactions. SI theory suggests that in situations where individuals have joint goals—such as in teams—performance is enhanced by promotive interactions whereby team members support each other's efforts to accomplish their mutual goal (D. W. Johnson & Johnson, 2005). Promotive interactions include effective communication that facilitates information exchange (D. W. Johnson & Johnson, 1984; Razmerita et al., 2020). By contrast, oppositional interactions, which involve ineffective communications (e.g., unclear, incomplete, or late messages) or no interaction, may lead to misunderstanding, reduce information sharing, and negatively impact team performance. Accordingly, in Study 1, we draw on SI theory and virtual team research to examine how team virtuality negatively influences on-campus teams' performance. In Study 2, we focus on how team information sharing mediates the negative effect of team virtuality on team performance and explore how team virtual communication behaviors mitigate this mediation effect. We begin by explaining how team virtuality hinders the team performance of on-campus student teams.

#### 3.3.1. Team virtuality's negative effect on team performance

Team virtuality refers to "the extent to which team members use virtual tools to coordinate and execute team processes" (Kirkman & Mathieu, 2005, p.702). Although research has conceptualized team virtuality as a multidimensional construct, geographical dispersion

and technology usage are the most frequently used dimensions (Gibson & Gibbs, 2006; Kirkman et al., 2012; Kirkman & Mathieu, 2005; Martins et al., 2004; Schweitzer & Duxbury, 2010). Given that our focus is on on-campus student teams, which may have little geographical dispersion, we focus our conceptualization on the teams' technology usage.

Research on teams suggests that team virtuality (e.g., technology use) may negatively impact team performance (for a review, see Gilson, Maynard, Jones Young, Vartiainen, & Hakonen, 2015 and Raghuram, Hill, Gibbs, & Maruping, 2019). This is because, when teams interact using technology, team members have less contextual (e.g., information about each other situations), paraverbal (e.g., voice tone), and nonverbal cues (e.g., facial expression) (Daft & Lengel, 1986; Sproull & Kiesler, 1986; Walther, 1992). Contextual cues, for example, may indicate whether teammates are not answering because they are sick or have a family emergency (Kirkman et al., 2002; Kirkman & Mathieu, 2005). Research suggests that the reduction—or absence—of these cues hinders the intimacy (e.g., interpersonal closeness) and immediacy (e.g., emotional connection) of interactions, increasing the ambiguity and misunderstandings in team communications (Cramton, 2001; C. B. Gibson et al., 2011; Hinds & Weisband, 2003; Raghuram et al., 2019). Therefore, if students lack these—or even some—important cues, they may have to exert more effort to communicate with their teammates while using technology (such as e-mail or instant messaging), lowering their motivation to interact and harming team performance.

Consistent with these arguments, much research has shown the information processing advantages for virtual teams when they interact face-to-face (C. B. Gibson et al., 2011; Hinds & Cramton, 2014). This research indicates that interacting face-to-face facilitates the formation of social relationships, contributes to developing a stronger sense of identity, and heightens awareness of others' situations (Hill et al., 2019). Taken together, on-campus student teams will experience the same detrimental effects of team virtuality as other types of virtual teams (e.g., geographically dispersed teams). Thus, we hypothesize the following:

> *Hypothesis 1:* In on-campus student teams, team virtuality is negatively associated with team performance.

### 3.3.2. The influence of team virtuality on team performance through team information sharing

We now focus on *why* the detrimental impact of team virtuality on team performance may arise in these on-campus student teams. To address this, we explore the mediating role of team information sharing in the negative association between team virtuality and team performance in on-campus student teams. Team information sharing refers to the "conscious and deliberate attempts on the part of team members to exchange work-related information, keep one another appraised of activities, and inform one another of job developments." (Bunderson & Sutcliffe, 2002, p.881).

SI theory proposes that when individuals have shared objectives, their team performance is enhanced through interactions in which team members encourage one another's efforts to achieve the shared goal—namely, positive interactions (Johnson & Johnson, 2005, 2009), which likely motivates information sharing with other team members. Drawing on this, management education research has suggested that because in cooperative learning environments, students share their goals, strategies that benefit the common objective, such as sharing the information, will enhance team performance (D. W. Johnson & Johnson, 1984; Razmerita et al., 2020). These notions are consistent with a considerable body of theoretical and empirical team research showing the favorable association of team information sharing with team performance. When team members share information, teams better understand all the possible alternatives available to them and all the informational resources necessary to attain their shared goal and enhance their team performance. Research, for example, has shown that teams make better decisions when all team members have access to the same information (Stasser & Titus, 1985). When team members lack relevant information (because another team member has not or only partly shared), they have information bias that benefits some team members but not the team as a whole (Dennis, 1996; Robert et al., 2008). In support of these arguments, Mesmer-Magnus and DeChurch's (2009) meta-analysis found that team information sharing was significantly and positively related to team performance.

Furthermore, virtual team research suggests that team virtuality hinders team information sharing. On the one hand, teams often take longer to transmit information through technology-mediated tools (e.g., e-mail), which hinders their ability to share information and know which is critical and when it should be shared with their teammates. Cramton's (2001) seminal work on partially distributed teams (some members in the same area and others

geographically distant) provides some indication of this. In this research, she found that partially distributed teams experience mutual-knowledge challenges affecting their ability to collaborate successfully. These challenges are defined by students' failure to share and remember contextual information, distribute information fairly among team members, and communicate and comprehend vital information—all critical aspects of successfully sharing information with the team.

Cramton (2001) illustrates team virtuality's influence on information sharing, with a team member sending an e-mail that purposefully or mistakenly excludes one or more team members. In one of the cases described by the author, the e-mail list had an error, including a member of another team while omitting a team member from important information. Because student teams often work for shorter durations than organizational teams, they also have less time to identify and recover from basic information-sharing errors like the one in the example. Due to their similar compositional characteristics (not the same geographical distance but a location distance when they work using technology for their coursework), we believe on-campus students experience these same challenges when using technology-mediated communication as partially distributed teams. Consequently, such information-sharing challenges might exacerbate misunderstandings, lengthen the time required to reach agreements, and ultimately negatively affect student team performance.

Additionally, when teams have fewer face-to-face interactions, it is more challenging to establish strong interpersonal relationships that stimulate information sharing (Hinds & Weisband, 2003; Pinjani & Palvia, 2013). Interpersonal relationships are harder to build when using technology-mediated communication because some tools reduce team members' ability to

have informal and spontaneous communications, which helps create shared understanding (C. B. Gibson & Gibbs, 2006; Hinds & Mortensen, 2005; Hinds & Weisband, 2003). In the lack of a shared context, team members may be less aware of the contextual information's importance to their colleagues, which inhibits their ability to understand each other situations. Although student teams share the same context in class, due to the multiple responsibilities of students and the current tendency to have some courses and other student-related activities online, they are likely not to share their context when they work on their teams outside their class. Thus, students will likely experience misunderstanding of their teammates' situations (Cramton, 2002; Cramton et al., 2007). This, in turn, increases the tendency for internal

attributions (Harvey et al., 2014; Kelley & Michela, 1980), growing interpersonal tensions and conflict (Cramton, 2002). An example of an internal attribution would be a student attributing a teammate's lack of participation due to student social loafing or freeriding (Jassawalla et al., 2009; Schippers, 2014; Urbig et al., 2016), rather than to an involuntary—or unavoidable—personal situation. These detrimental exchanges will hurt students' interpersonal relationships and motivation to share information with their team or some team members.

These notions are consistent with Mesmer-Magnus and colleagues' (2011) meta-analysis showing that teams with higher degrees of team virtuality communicate less information than those with lower levels of virtuality. Also, this is consistent with Ortiz de Guinea, Webster, and Staples's (2012) meta-analysis showing the impact of team virtuality on different team processes, including knowledge sharing. These authors also found that this likely negative impact of team virtuality on team knowledge sharing was more prominent for teams working on short-term projects (akin to on-campus student teams). An example of this is shown by Alge, Wiethoff, and Klein's (2003) experimental study comparing 66 teams of undergraduate students. This study indicated that short-term teams (similar to on-campus students) shared less information than teams with experience or who anticipate working together in the future since they were more focused on completing the task than building interpersonal relationships. In addition, due to the loss of social presence and signals provided in face-to-face communications, this research indicated that short-term teams exchanged less information using technology-mediated communication than when working in person. Taken together, because team virtuality is negatively associated with team information sharing and team information sharing is positively associated with team performance, it follows that in on-campus student teams, team information sharing will mediate the negative effect of team virtuality on team performance. Consequently, we hypothesize:

> *Hypothesis 2:* In on-campus student teams, team virtuality is negatively related to team performance through team information sharing.

### 3.3.3. The influence of team virtual communication behaviors

We draw on studies on virtual teams (Lacerenza, & Salas, 2017; Hill & Bartol, 2016; Jarvenpaa & Leidner, 1999) to predict that virtual communication behaviors will mitigate the detrimental impact of team virtuality on team information sharing and, ultimately, team performance. Virtual communication behaviors are essential for student teams that only work on the course project (short-term projects) since they have less time to create strong

relationships with all their teammates and less time to overcome the challenges of team virtuality (e.g., information sharing). Thus, when students engage in virtual communication behaviors, teams are more likely, for example, to reduce misunderstandings and build mutual knowledge (Cramton, 2001), lessening the detrimental impact of team virtuality on team information sharing.

Virtual team research supports the notion that virtual communication behaviors will mitigate the impact of team virtuality on information sharing and, in turn, enhance team performance but has yet to examine this moderated mediation effect. This research has shown that teams with less face-to-face interaction—higher in team virtuality—may find it more challenging to create interpersonal bonds that stimulate team processes such as information sharing (Mesmer-Magnus et al., 2011). Virtual communication behaviors, for example, lessen team virtuality's adverse effect on team information sharing by promoting behaviors that help reduce team uncertainty and ambiguity. They also help overcome the challenges associated with reduced social cues (Kirkman & Mathieu, 2005) of technology-mediated communications. Virtual communication behaviors focused on lowering misunderstandings also help boost positive interpersonal relationships, making it easier for team members to work together and promoting information sharing to achieve their team tasks and goals more easily and quickly. Higher levels of virtual team behaviors will thus reduce the negative effect of team virtuality on information sharing and, ultimately, team performance.

When working virtually, an improvement in team information sharing and, ultimately, team performance may be achieved, for example, when team members *use technology effectively* and have *supportive and responsive* communication (Hill & Bartol, 2016; Jarvenpaa & Leidner, 1999). Two main arguments suggest the moderating influence of these virtual communication behaviors on the negative association between team virtuality and team information sharing, leading ultimately to higher team performance. First, research from a variety of streams (e.g., media richness theory, media synchronicity theory, task-technology fit from information systems research; social information processing from computer-mediated communication research, and virtual teams from organizational behavior research) supports the notion that technologies vary in their ability to fit particular purposes and tasks (for a review, see Raghuram, Hill, Gibbs, & Maruping, 2019). This is because communication technology's effectiveness depends on the medium's capabilities to facilitate specific team goals. E-mails and instant messaging, for instance, are better suited for team members conveying messages and information that do not need contextual or visual signals for comprehension (e.g., to share

information). In contrast, richer communications (e.g., video conferencing or face-to-face) are better suitable for team members conveying more complex messages that need additional contextual clues to prevent misconceptions (e.g., solve misunderstandings) (Hill & Bartol, 2016). This suggests that team members should improve their understanding of *when* each technology-mediated tool (e.g., e-mail vs. videoconference) should be used to complete each team task effectively; this is referred to as the effective use of technology.

Second, teams whose members are supportive and responsive to one another may generate shared understanding and identity (Mortensen & Hinds, 2001) and sustain and develop higher levels of trust (C. B. Gibson & Manuel, 2003; Jarvenpaa & Leidner, 1999), which are all essential for improving team information sharing and, ultimately, enhancing team performance. For example, in their study of 350 master's students working in teams through a six-month course project in global virtual teams, Jarvenpaa and Leidner (Jarvenpaa & Leidner, 1999) found that teams with more equitable, predictable, and regular communication developed higher team trust levels as opposed to those using unpredictable interactions. In this seminal article about how individuals communicate in global virtual teams, the authors found that teams with higher levels of trust at the start of a project kept those levels of trust throughout the project when team members received clearer and more responsive messages communication.

Collectively, these theoretical arguments and the empirical findings on global virtual teams suggest that on-campus student teams that employ virtual communication behaviors may be able to mitigate the adverse effects of team virtuality on team information sharing, thereby enhancing team performance (see Figure 4). Therefore, we suggest two virtual communication behaviors that reduce the detrimental impact of on-campus student team virtuality on performance: (1) effective use of communication technologies and (2) supportive and responsive communication. Thus, we hypothesize:

> *Hypothesis 3:* In on-campus student teams, the negative indirect effect of team virtuality on team performance through team information sharing is moderated by team virtual collaboration behaviors, such that this indirect effect is stronger at higher levels of team virtual collaboration behaviors

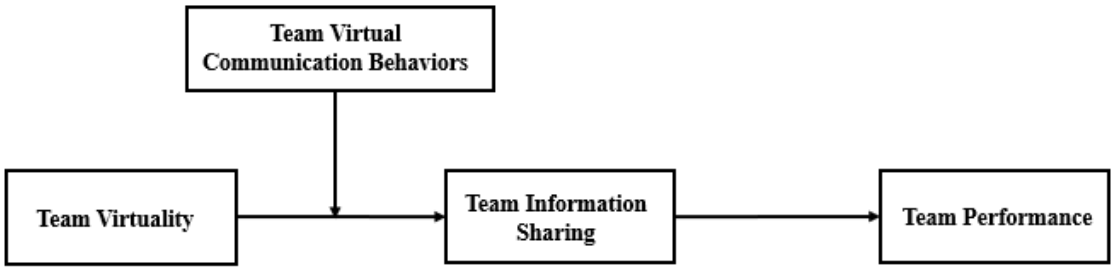


*Figure 4 – Overall Theorized Model (Study 2)*

### 3.4. Overview of studies

We designed two studies to test our hypothesis. In Study 1, using a time-lagged survey design with a sample of undergraduates, we investigated the impact of team degree of virtuality on team performance. In Study 2, also using a time-lagged survey design and a sample of undergraduate students, we examined to what extent team information sharing mediated the relationship of team virtuality with team performance and to what extent team virtual communication behavior mitigated this mediation effect of team virtuality and team performance via team information sharing. These two samples were well suited for investigating our hypothesis because we were interested in understanding communication in *on-campus student teams*: teams that are not entirety virtual teams (e.g., global teams, also called geographically distributed teams) and have the characteristics of ad hoc teams (e.g., teams that will not necessarily work together in the future).

#### 3.4.1. Study 1

##### 3.4.1.1. Sample

We tested Hypothesis 1 using a sample of students from an introductory management course delivered at a large eastern university. At the beginning of the semester, students were randomly allocated to self-managing project teams of four to six individuals to complete a project worth 30 percent of the class mark. Most of the teamwork was conducted outside of class, with members of each team deciding the amount to which they would engage virtually or in person. Data indicated that the degree of virtuality in the sample ranged from 28% and 79% (mean = 52%). Consequently, teams engaged in substantial team virtuality, making the sample suitable to assess the hypothesis.

Participation in the study was voluntary, with a response rate of 91% (227 students). Forty team members were dropped (17.6%) from the study because an assessment of their virtual collaboration effectiveness by their team members was not available. The class included 227 students in 44 teams. Missing data over the waves reduced data to 187 students from 40 teams. The final sample comprised teams with four to seven members. The average age of students was 20.46 (SD 1.22 years), with 50.8% females, and ethnicity of 49.2% White, 21.9% Asian, 3.2% Black or African American, 10.7 Hispanic, and 15% other.

#### 3.4.1.2. Task and procedure

The team assignment mirrored a consulting project in which teams studied a current problem or practice associated with managing human capital, performed a critical analysis based on their research results, and developed suggestions for how businesses could most effectively handle the issue. The study and recommendations demanded that the team collaborate to discuss and integrate ideas. The student team worked on the team assignment for the academic term, ending in a presentation to their class. Teams were asked to submit intermediate milestones which required them to collaborate throughout the semester on the project.

We collected data in two waves. The first data collection took place during the first week of class, and the second data collection was done approximately 14 weeks later. At Time 1, we collected demographic information and control variables before the students were assigned to their teams. At Time 2, at the end of the semester (when the project was finished), we ask students to report their team's degree of team virtuality (i.e., reliance on mediated communication rather than FtF) and assess their team performance.

#### 3.4.1.3. Measures

***Team virtuality*.** Students reported the total hours estimated working virtually and the hours estimated working face-to-face on tasks related to the team. We computed the degree of virtuality as the percentage of hours working virtually related to the total hours worked together face-to-face or virtually. This follows the conceptualization of Kirkman and Mathieu (2005) and the approach taken in past studies, computing the degree of virtual communication as the percent of interaction using non-face-to-face media (Hill et al., 2014; Maynard et al., 2012). The team degree of virtual communication varied between 28% and 79% (mean = 52.24%, SD = 12.19). The aggregation statistics were acceptable for this measure [ICC(1) = 0.15 ($F = 1.79$; $p < .01$); ICC(2) = 0.44] and we aggregated the individual responses to the team level.

***Team performance.*** We assessed team performance using Kirkman and Rosen's 6-item measure of (1999) team productivity, rated on a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree). Example items are my team, " "meats or exceeds team goals," and "produces quality work." ($\alpha = 0.93$). The ICC values for this measure were ICC(1) = 0.11 ($F = 1.60$; $p < .05$) and ICC(2) = 0.38. We estimated rwg using an excel tool by Biemann, Cole, and Voelpel (2012) that allows the user to specify the desired null distribution. We computed this index based on the uniform distribution, which assumes no systematic sources of bias in the responses (median rwg = .92). Taken together, these ICC and rwg values provide sufficient justification for aggregation to the team level.

***Controls.*** We explored several variables of theoretical relevance to our endogenous variables based on previous team research to rule out alternative explanations such as team size and task interdependence (van Bunderen et al., 2018). Because previous research has shown that self-managed teams may be affected by the perception of task interdependence, we included it in the analysis using Bishop and Scott's (2000) 4-item scale ($\alpha= 0.73$). A sample item is "Team members must frequently coordinate their efforts with each other." We also controlled for team attitudes toward virtual collaboration since the research suggests that teamwork attitudes may alter team members' perception of their ability to be effective in a team, which may affect their performance (e.g., Thoms, Moore, & Scott, 1996). To measure team attitudes toward virtual teamwork, we used 3 items adapted from Thoms et al. (1996)'s five-item measure of attitude toward self-managing teams to assess attitudes toward virtual collaboration. "Self-management teams" was replaced by "working virtually with my team." A sample item from this scale is "I am happy about working virtually with the members of my team" ($\alpha = 0.94$). Finally, guided by previous research showing that team cognitive ability is an important control variable for studies using team performance as an endogenous variable (e.g., Barrick et al., 1998; Harrison, Price, Gavin, & Florey, 2000), we controlled for team cognitive ability using the mean of team members' GPA. GPA has already been used as a control variable to control prior student performance (e.g., Guillaume, van Knippenberg, & Brodbeck, 2014).

Guided by previous research and because we were not interested in the agreement between the team members, we used additive compositional models (the mean score of the individual perceptions) to aggregate team members' attitudes toward virtual teamwork and perceptions of task interdependence (e.g., Chan, 1998; Glick, 1985). Finally, to preserve degrees of freedom, because the control variables were non substantially correlated, they were

not carried forward in the analysis (Becker, 2005; Bono & McNamara, 2011; Seibert et al., 2013; Shoss et al., 2013).

#### 3.4.1.4. Results

Table 6 provides descriptive statistics for and bivariate correlations among study variables.

| | Mean | SD | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|---|
| 1. Team attitudes toward virtual teams | 5.55 | 0.59 | – | | | | | |
| 2. Team cognitive ability | 3.36 | 0.17 | 0.06 | – | | | | |
| 3. Team size | 5.18 | 0.71 | -0.25 | 0.07 | – | | | |
| 4. Team task interdependence | 6.16 | 0.37 | 0.34* | 0.07 | 0,26 | – | | |
| 5. Team degree of virtuality | 0.52 | 0.12 | 0.14 | 0.00 | -0.22 | –0.08 | – | |
| 6. Team performance | 6.20 | 0.50 | 0.30 | 0.18 | 0.12 | 0.13 | -0.35* | – |

*Note. n = 40 teams.*
*** p < .01; * p < .05*

*Table 6 – Descriptive Statistics and Correlations (Study 1)*

First, we explored the variability in the degree of virtuality of those on-campus student teams. Team reported a variability between 28% and 79% (mean = 25.24%, SD = 12.19) in their team virtuality. This preliminary evidence suggests that despite being considered in-person teams, students on campus participate in a substantial amount of technology-mediated communication during course teamwork. Hypothesis 1 predicted that the team's degree of virtuality was negatively associated with team performance outcome. We tested this relationship using ordinary least squares (OLS) regression to determine the effect of team virtuality on team performance. As expected, we obtained an overall negative impact of the degree of team virtuality on team performance (b=-1.43, SE=0.62, t=-2.30, p<0.05, CI [-2.69, -0.17], adjusted $R^2$ of 0.10).

#### 3.4.1.5. Discussion

The goal of Study 1 was to explore the degree of virtuality of on-campus teams and the possible effect of team virtuality on team performance. To develop our hypothesis, we drew on previous virtual team research suggesting that team virtuality negatively affected team performance. The reported degrees of virtuality and the negative effect of virtuality on team performance support our argument that on-campus student teams may use different degrees of virtuality in their communications, affecting student interactions and team performance. This result is consistent with Purvanova and Kenda' (2021) meta-analytical finding that team

virtuality harms team outcomes on student teams. According to their findings, student teams (and mostly samples of undergraduate student teams working together for ten days to 4 months and 6 months to 4 years) suffer more negative effects from team virtuality on team outcomes than organizational teams. This emphasizes the necessity and significance of student teams using working practices that might assist them in overcoming the challenges of virtual teamwork.

### 3.4.2. Study 2

Although Study 1 provides empirical evidence of the detrimental effects of team virtuality on on-campus student teams' performance, one limitation was the absence of a possible reason *for this harmful effect*. Thus, in Study 2, we included team information sharing as a possible mediating mechanism between team virtuality and team performance and team virtual communication behaviors as a likely moderate for this indirect effect.

#### 3.4.2.1. Sample

In Study 2, we used a sample of undergraduate students from a management organizational behavior course taught before the COVID-19 in a large east-coast university in the United States. As in Study 1, students were randomly assigned to work in these self-managed project teams that had to frequently interact for a course project over 14 weeks. The team project accounted for 31% of their overall course grade. The majority of the course sessions consisted of lectures that taught course topics. Although student teams sometimes collaborated during class, most of their project work was done outside of class. Thus, team members were free to determine the frequency of face-to-face and technology-mediated communication. This resulted in natural variance in the degree of virtuality amongst teams. In this approach, the teams in our sample may be described as hybrid teams that combine face-to-face contact with mediated communication (Fiol & O'Connor, 2005).

Students were randomly assigned to teams of 5 to 6 members to conduct a semester-long project in an introductory organizational behavior class. The course included general teamwork concepts, but students received no instruction explicitly associated with collaborating. Students earned extra credit toward their course grades for participating in the study. Participation in the survey was voluntary, and the response rate was 76.3%. Missing data over the waves reduced data to 209 students in 49 teams. The average age of students was 18.55 years (S.D. 0.79), with 53.6% females and reporting ethnicity of 57.6% European American or White, 24.3% Asian, and 18.1% other (e.g., Hispanic, pacific islander, or Indian).

#### 3.4.2.2. Task and procedure

The team's task involved developing a 12-minute presentation of a fictitious case scenario delivered in a creative presentation to demonstrate understanding and application of course concepts. Each team member had a significant role in the presentation, which was performed in front of other teams at the end of the semester. Consequently, every team member's input was essential to the presentation's success. Cooperation among team members was fundamental for teams to successfully brainstorm creative situations for the case, pick the best idea, determine how to incorporate the course concepts, and develop and prepare for the presentation. Because collaboration was fundamental to the team project and represented a significant portion of the course grade, students were encouraged to interact to perform well in their presentations.

This study involved two waves of data collection. In the first wave, before being allocated to their teams (at the beginning of the semester), students provided demographic information and other control variables (e.g., personality traits). In the second wave, after teams had completed their work, students were asked to report their team degree of virtuality, team information sharing, and team virtual collaboration behaviors. To avoid common source and common method bias (Podsakoff et al., 2003, 2012), we assessed team performance with the course presentation grade, reported after the project was completed and the students had presented their project to the rest of the class.

#### 3.4.2.3. Measures

Unless otherwise noted, we used a 7-point Likert scale, 1 (*strongly disagree)* to 5 *(strongly agree*), for the survey measures. For team-level variables that required consensus among team member ratings before aggregation to the team level, we justified aggregation by first calculating intraclass correlations, ICC(1) and ICC(2), which respectively assess the proportion of the total variance accounted for by group membership and the reliability of the group level means (Bliese, 2000). Where appropriate, we also computed interrater agreement ($r_{wg}$; James, Demaree, & Wolf, 1984). The measure descriptions below show acceptable values for aggregation statistics to justify aggregation (Bliese, 2000; James et al., 1984)

***Team virtuality*.** In Study 2, we improved the measurement of team virtuality by asking students to report the percent of total interactions in the team that had occurred using different communication methods (e.g., face-to-face, phone, text, e-mail). Following the conceptualization of Kirkman and Mathieu (2005) and the approach taken in past studies, we

computed the degree of virtual communication as the percent of interaction using non-face-to-face media (Hill et al., 2014; Maynard et al., 2012). Specifically, we asked students to indicate the percentage of time they spent communicating face-to-face and using technology (e.g., phone, text, e-mail, videoconferencing, document sharing). The figures reported had to total 100%. We then subtracted the percentage they reported communicating face-to-face to determine the degree of virtuality and aggregated the data to the team level. The degree of virtual communication varied between 13% and 73% (mean = 43.83%, SD = 15.44). The aggregation statistics were acceptable for this measure [ICC(1) = 0.36, ICC(2) = 0.71], and we aggregated the individual responses to the team level.

***Team information sharing.*** We measured team information sharing using 3 items from Bunderson and Sutcliffe (2002). Students rated a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree) ($\alpha = 0.86$). Examples of items are my team "exchanges a lot of information about the task" and "readily shares information that might be useful to other team members of the team." The ICC values for this measure were ICC(1) = 0.27 ($F = 2.49$; $p < .001$) and ICC(2) = 0.60. We estimated rwg using an excel tool by Biemann, Cole, and Voelpel (2012) that allows the user to specify the desired null distribution. We computed this index based on the uniform distribution, which assumes no systematic sources of bias in the responses (median rwg = .86). Taken together, these ICC and rwg values provide sufficient justification for aggregation to the team level.

***Team virtual communication behaviors.*** We adapted Hill and Bartol's (2016) 3-factor scale to assess virtual communication behaviors. We included the six items from Hill and Bartol (2016) related to virtual communication behaviors and deleted those related to collaborating across cultures. Students rated a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree) ($\alpha=0.90$). The scale consisted of two factors. The first factor, effective use of technology for virtual communication, had three items (e.g., "my team "sends virtual communications with a positive, encouraging tone") explaining to what extent team members use technology effectively for each team task. The second factor, supportive and responsive virtual interactions, had five items (e.g., "my team keeps team members informed of progress and issues") describing the extent to which the team members responded on time and gave substantive feedback. Following research suggesting the importance of responsive and supportive communications in virtual teams (see Jarvenpaa & Leidner, 1999), we added three additional items capturing responsive and supportive communications: my team "responded quickly to each others' requests," "communicated frequently and avoided lengthy silences,"

"responded to each others' communications in a timely manner." Our goal was to strengthen the measurement by focusing on virtual *communication* interactions.

To examine the factor structure of virtual communication behaviors, we performed a confirmatory factor analysis (CFA) in Mplus. A two-factor model provided a good fit to the data with $\chi 2(18) = 37.57$, $p < 0.001$, Tucker–Lewis index (TLI) =0.94, comparative fit index (CFI)= 0.92, root mean square error of approximation (RMSEA) = 0.07, standardized root-mean-square residual (SRMR) = 0.04. This two-factor model fit the data significantly better than did a the one-factor model with $\chi 2(20) = 43.915$, $p < 0.001$, TLI=0.93, CFI= 0.95, RMSEA= 0.07, SRMR= 0.04. Finally, the chi-square difference tests (the change in deviance test based on loglikelihood values and scaling correction factors obtained with MLR) comparing differences between the two-factor model and the one-factor was statistically significant with $\Delta\chi 2(2)$ 7.826, $p < 0.05$, indicating the two-factor model structure is significantly better than the other two models and supporting the discriminant validity of the two virtual communication behaviors. Because we were interested in virtual communication behaviors at the team level, we computed the intraclass correlations (ICC(1) and ICC(2)) (Bliese, 2000) and interrater agreement ($r_{wg}$; James, Demaree, & Wolf, 1984). The measure of agreement among peer ratings produced a median of 0.91, an ICC(1) of 0.17 ($F = 1.81$; $p < 0.005$), and an ICC(2) of 0.45. Taken together, these statistics provide sufficient justification for aggregation at the team level (Bliese, 2000).

***Team performance.*** We assessed the team's performance using the team's case presentation grade. The course instructor provided a course rubric that four graduate teaching assistants (TAs) used to rate the case presentations. The rubric included the amount to which the case presentation appropriately represented the course topics, the content, structure, and flow of the presentation, and the team's ability to execute the presentation. TAs first met with the instructor to discuss the rubric to ensure they were all interpreting it similarly. All TAs individually rated all the presentations and then met to discuss their ratings and reconcile minor differences in scores. This approach to computing the team performance matches the consensus method of aggregation described by Kirkman, Tesluk, and Rosen (2001), where judges discuss individual ratings to reach consensus.

***Controls.*** Drawing on previous research, we identified variables that research has suggested are relevant predictors of team information sharing or team performance. Thus, we controlled for team size, and team members' average Big 5 personality traits (Costa and

McCrae, 1992) (e.g., Barrick, Neubert, Mount, & Stewart, 1998; Barry & Stewart, 1997; Bradley, Baur, Banford, & Postlethwaite, 2013; LePine, 2003; van Vianen & De Dreu, 2001), and team cognitive ability (e.g., Barrick et al., 1998; Harrison, Price, Gavin, & Florey, 2000). In addition, because the team's performance on this task might also be influenced by team members' knowledge of the course topics, we also controlled for team members' mean percentage exam grade as a measure of the team's task domain knowledge. Given their additive compositional nature these controls were aggregated using the mean of members across the team (Chan, 1998). To preserve degrees of freedom, the team task domain knowledge was retained as a control variable in the analysis because it was the only variable significantly correlated with one of the endogenous variables in our model (Becker, 2005; Bono & McNamara, 2011; Seibert et al., 2013; Shoss et al., 2013).

#### 3.4.2.4. Preliminary analysis

We first conducted a confirmatory factor analysis (CFA) to determine the discriminant validity of team virtual collaboration behaviors and team information sharing using Mplus 8.7 (Muthén & Muthén, 2007). We tested a second-order two-factor model with team virtual collaboration behaviors and team information sharing. In this model, the team virtual collaboration behaviors' individual variables were loaded on the two first-order factors (two dimensions) for team virtual collaboration behaviors and then that first-order factor was loaded into a second-order factor with an additional second-order factor for team information sharing $\chi 2(41) = 80.97$, $p < 0.001$, TLI =0.93, CFI= 0.95, RMSEA = 0.07, SRMR = 0.05. This was compared with a one-factor model in which all the items were loaded on one factors $\chi 2(44) = 198.17$, $p < 0.001$, TLI =0.76, CFI= 0.81, RMSEA = 0.12, SRMR = 0.08. The results indicated that the second-order two-factor model provided a significantly better fit than the one-factor model $\chi 2(s) = 146.57$, $p < .001$. This supports our use of team virtual collaboration behaviors as two different constructs.

#### 3.4.2.5. Results

Table 7 provides descriptive statistics for and bivariate correlations among study variables.

| **Variables** | **Mean** | **SD** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Team openness to experiences | 3.73 | 0.22 | - | | | | | | | | | | | |
| 2. Team conscientiousness | 3.82 | 0.27 | 0.15 | - | | | | | | | | | | |
| 3. Team extraversion | 3.65 | 0.29 | 0.34* | 0.11 | - | | | | | | | | | |
| 4. Team emotional stability | 2.37 | 0.27 | -0.30 | -0.16 | 0.00 | - | | | | | | | | |
| 5. Team agreeableness | 3.83 | 0.27 | 0.27 | 0.18 | 0.33* | 0.08 | - | | | | | | | |
| 6. Team size | 4.27 | 0.97 | 0.00 | 0.05 | -0,04 | -0.07 | -0.18 | - | | | | | | |
| 7. Team's task domain knowledge | 78.85 | 5.83 | 0.05 | -0.03 | -0,18 | -0.27 | -0.04 | -0.08 | - | | | | | |
| 8. Team attitudes toward virtual teams | 3.34 | 0.39 | 0.04 | 0.01 | 0.23 | 0.15 | 0.16 | 0.15 | -0.13 | - | | | | |
| 9. Degree of virtuality | 43.83 | 15.44 | -0.01 | -0.12 | -0,02 | -0.18 | 0.11 | -0.13 | -0.06 | 0.17 | - | | | |
| 10. Team virtual collaboration behaviors | 3.95 | 0.38 | -0.02 | 0.26 | 0.20 | 0.16 | 0.11 | 0.33* | 0.15 | 0.26 | -0.32* | - | | |
| 11. Team information sharing | 3.95 | 0.52 | 0.12 | 0.20 | 0.25 | 0.09 | 0.14 | 0.05 | 0.10 | 0.09 | -0.53** | 0.71** | - | |
| 12. Team performance | 83.82 | 7.55 | -0.01 | 0.17 | 0.00 | -0.04 | 0.17 | 0.03 | 0.34* | -0.10 | -0.11 | 0.42** | 0.32* | - |

*Note.* $n$ = 49 teams.

** $p < .01$

* $p < .05$

*Table 7 – Descriptive Statistics and Correlations (Study 2)*

We used the SPSS PROCESS macro from Hayes (2013) to test our hypotheses. The macro tests individual paths in the theoretical model using hierarchical regression and tests for mediation and moderated mediation effects using bootstrapping procedures. The reported bootstrapping results are for 5,000 bootstrap samples and a 95% confidence interval. We used mean-centered predictors.

Hypothesis 2 predicted that team information sharing mediated the negative relationship between on-campus student team virtuality and team performance. We assessed our hypothesis using Model 4 in PROCESS. In line with our predictions, we found that team virtuality was negatively and significantly associated with team information sharing performance (indirect effect=-0.02, Boot SE=0,00, 95% CI [-0.03,-0.00]), and team information sharing was positively and significantly related with team performance (indirect effect=4.80, Boot SE=2.27, 95% CI [0.22,9.37]. We also found that team information sharing significantly mediated the negative indirect effect of the degree of virtual collaboration on team performance (indirect effect=-0.09, Boot SE=0,05, 95% CI [-0.19,-0.01]). Thus, Hypothesis 2 was supported.

Hypothesis 3 predicted that team communication behaviors moderated the mediation of team virtuality on team performance via team information sharing. To evaluate this moderated mediation, we first tested the interaction effect between team virtuality and team communication behaviors on team performance using PROCESS Model 1. The interaction between team virtuality and team virtual communication behaviors on team performance was not statistically significant (interaction term=-0.01, SE=0.01, 95% CI [-0.008, 0.03]). Interestingly, however, we found a significant positive effect of virtual communication behaviors on team performance conditioned to team virtuality at zero (b=0.83, Boot SE=0.14, 95% CI [0.56, 1.11], $p<0.01$) as well as a significant negative direct effect of on-campus student team virtuality on team performance conditioned to virtual communication behaviors at zero (b=-0.11, SE=0.003, 95% CI [-0.02, -0.004], $p<0.05$).

We also tested the moderated mediation using Model 7, which confirmed our initial results regarding the non-significant interaction. We found that the moderated mediation index was non-significant (b=0.05, Boot SE=0.06, 95% CI [-0.10, 0.17]). In addition, we found a significant positive effect of virtual communication behaviors on information sharing conditioned to team virtuality at zero ( (b=0.83, Boot SE=0.13, 95% CI [0.56, 1.11],) as well as a significant negative direct effect of team virtuality on team performance conditioned to

virtual communication behaviors at zero (b=-0.01, SE=0.003, 95% CI [-0.02, -0.004]) (see Hayes, 2018, p.229). We recognize that these main effects should be examined with care and do not give proof of the main effects. However, they provide some important indicators of the possible individual effects. In light of this, we regressed the impacts of team virtuality and virtual communication behaviors on team information sharing. We discovered a non-significant negative impact of team virtuality on team information sharing (b=0.12, SE=0.07, p>0.05) and a significant positive effect of virtual communication practices on team information sharing (b=0.83, Boot SE=0.14, 95% CI [0.56, 1.04]). See Table 8. Although Hypothesis 3 was not supported, these findings show that virtual communication behaviors may be advantageous for all on-campus student teams, even those with lower degrees of virtuality.

| | **Model 1 Team Information Sharing** | **Model 2 Team Performance** |
|---|---|---|
| Constant | 4.08 (0.66)*** | 33.51 (15.7) |
| Team degree of virtuality | -0.01 (0.00)** | 0.04 (0.07) |
| Team virtual collaboration behaviors | 0.83 (0.13)*** | |
| Team degree of virtuality*Team virtual collaboration behaviors | 0.01 (0.01) | |
| Team information sharing | | 4.80 (2.27)* |
| Team task domain knowledge | -0.00 (0.01) | 0.40 (0.17)* |
| $R^2$ | 0.62 | 0.20 |
| F | 18.15*** | 3.80* |

*Note.* n = 49 teams. Unstandardized regression coefficients (standard error). Mean-centered predictors.
*** $p < .001$
** $p < .01$
* $p < .05$

*Table 8 – Results of Moderated Mediation Analysis (Study 2)*

### 3.4.2.6. Discussion

Study 1 showed considerable variation in the degree of virtuality in on-campus student teams (27% and 79%), and team virtuality significantly harmed team performance. In Study 2, the degree of virtuality also showed considerable variation between 13% and 73%, and team

virtuality damaged team performance by reducing team information sharing. Our results indicated no significant interaction between effective on-campus student teams' virtual communication behaviors and team virtuality. Even when virtuality was the lowest, virtual communication behaviors improved student team performance. These results suggest that virtual communication behaviors can be helpful for teams at both low and higher levels of virtuality. They should be even more important for teams that use more technology-mediated communication. This is critical because if management educators are aware of how team virtuality might damage their student teams learning and performance, they may provide students with insights at the beginning of their courses on overcoming such adverse effects.

At the end of the courses, we also asked the students two open-ended questions about their perceptions of the virtual communication behaviors they considered enabled and hindered their team performance. Following examples from prior research (Cameron & Webster, 2011), we coded these responses according to the two factors from Hill and Bartol's virtual collaboration behavior scale (2016). This was not meant to be an exhaustive qualitative analysis but rather to validate the students' perceptions about how behaviors matched the virtual communication behaviors recommended by prior research and assessed by the measurement.

We found that students consistently stated that using technology was vital for their team performance. The theme "effective use of technology" represented 8.52% of the 300 total student comments. An illustration of this was a student recognizing that rich and lean communication is better for specific team purposes: "It is a lot easier to get to the bottom of a situation when talking on the phone than restricted e-mails or texts. E-mail and texting are good when assigning work and arranging when and where to meet. We used e-mail to share completed work to compile a concise document."

Conversely, students reported that their team performance was hindered when they mainly relied on lean communications instead of letting the appropriate technology: "At times, it took longer to get to the root of a problem because people would only text and e-mail rather than call or meet face to face." Likewise, a student reported the importance of rich communications when needed: "I think we were much more effective when we met face to face, we were much more productive than when we were meeting virtually. Some of the reasons that I believe that hurt us is that it was much harder to communicate over writing and typing rather than talking. The reason for this is that it is easier to explain things while talking other than texting."

Furthermore, the theme "supportive and responsive virtual communications" represented 91.43% of the 300 total student comments. An example of this was a student expressing: "To facilitate effective virtual collaboration, we made sure that each group member responded to all e-mails... We also made sure to text group members who were not present at meetings after about 10 minutes to make sure they were coming or knew that we were meeting that day." Also, a student reported, "Although we mostly just met face-to-face, it was very helpful when members responded promptly to text messages and Facebook messages. We agreed that prompt communication was necessary."

Conversely, students expressed that not responding to messages affected their interactions: "The number one thing was people not responding to requests/deadlines and then popping up last minute with some type of "I had so much other work" excuse as to why their work was late." and other students expressing "The behavior that hurt the effectiveness of the team the most was the inability to be constant and expeditious with the e-mails. I believe in some instances we were too confident that our project would come together without 100% dedication, including checking e-mails and responding on time." And "Some people would often not respond to e-mails or texts in a timely fashion, and this would be very stressful because I was put in charge of putting everything together after we had all done our individual sections and if I was missing a section from a team member, I could not contact them. This led to a lot of frustration and stress." This analysis provided additional insights regarding the importance of effective virtual communication behaviors to enhance on-campus student team performance.

### 3.5. General Discussion

Due to the dramatic increase in the use of technologically mediated media, on-campus student teams are likely to have a degree of virtuality that may affect their course performance. Our primary purpose was to make management professors aware of how much their "traditional" on-campus student teams interact virtually, how this affects the team's performance, and what can be done to help these teams overcome this effect.

#### 3.5.1. Theoretical implications

Our research provides three contributions to the literature on management education. First, by examining the impacts of virtuality on student teamwork in conventional on-campus management courses, we extend research on management education's cooperative learning approach to two contemporary realities that are mostly ignored in on-campus classes: (1) the

new generation of business schools students is composed of "digital natives" who are inclined to interact primarily via virtual communications (Colbert et al., 2016),; and (2) all business school student teams today utilize to some degree, technology-mediated tools to communicate. Given that the new generations have grown up using technology-mediated communications, the educational community may believe that they do not require guidance or instruction on working effectively in these environments (Aritz et al., 2018). However, our research shows that management students certainly need some guidance to communicate in this environment effectively. Because a fundamental goal of contemporary management courses (on-campus, hybrid, and online courses) is to develop the students' knowledge, skills, and abilities (KSA) (Makarius & Larson, 2017) necessary for their success in future work environments, we emphasized the significance of encouraging students to develop positive virtual communication behaviors in their courses.

Second, by contributing to understanding effective virtual communication behaviors, we extend the limited empirical research related to the effect of virtual communication behaviors on team performance (e.g., Gibson & Gibbs, 2006; Hill & Bartol, 2016; Jarvenpaa & Leidner, 1999) to more traditional in-person teams such as the on-campus student teams. Existing research in teams with members that rely on virtual communication has generally used samples with geographically distributed teams and has focused on the impact of team geographic dispersion on team performance rather than the specific impact of teams' use of virtual communication (Cramton & Webber, 2005; Ganesh & Gupta, 2008; Hoch & Kozlowski, 2014). Therefore, we advance research in this field by shedding light on an essential process by which team virtuality may affect team performance—team information sharing—in teams that are not geographically separated.

Interestingly, we did not find support for our assumption that on-campus student teams' virtual communication behaviors moderated team virtuality effects on team performance. It is possible that the range of team virtuality restricted our ability to identify this moderation effect. Given the technological advances today, most student teams have higher rather than lower levels of virtuality. One potential theoretical explanation for this non-finding is that virtual communication behaviors are equally crucial for all degrees of team virtuality because, in general, they improve team processes and dynamics that help team performance. Most importantly, this non-significant finding is relevant because it shows that students in on-campus student teams should always be aware of employing effective virtual communication behaviors regardless of their degree of team virtuality. Thus, focusing on effective virtual team

communication behaviors is critical for the majority—if not all—on-campus student teams, and management educators should thus promote and encourage such behaviors in their courses.

Third, we step towards identifying and synthesizing key virtual communication behaviors that might help students in on-campus project teams enhance their teamwork. By so doing, we aim to raise awareness regarding the importance of management professors paying attention to these virtual communication behaviors early on in their courses. Presumably, promoting virtual communication behaviors will increase students' awareness of strategies for overcoming the challenges posed by team virtuality while working in teams. This criticality is essential for organizational behavior courses focused, for example, on leadership and also for non-organizational behavior courses focused on strategy, finance, or business ethics.

### 3.5.2. Practical implications for management educators

Our findings have important teaching implications for management educators using team projects in their courses. First, this study's samples comprised student teams from traditional on-campus courses. Our samples represent student teams in on-campus classes who may have face-to-face opportunities but, for various reasons (e.g., convenience, difficulties scheduling face-to-face meetings), choose to use high levels of virtuality in their communications. We found a considerable variation in their degree of virtuality between 28% and 79% in Study 1 and 13% and 73% in Study 2. This serves as a caution for management educators that even "traditional"-appearing student teams may have high degrees of team virtuality, with negative implications for their team performance. It is also likely that, because students today are skilled at using various information communication technologies, they might underestimate the need for and importance of adopting communication behaviors to use technology effectively. As noted by Kirkman and Mathieu (2005), "…it is not enough to simply know "how" to use technology, but team members must also know how to leverage technology to facilitate processes related to team tasks." Consequently, to facilitate more effective teamwork in their courses, we recommend management educators improve students' knowledge of the challenges of team virtuality and examine ways for students to compensate for such potentially negative consequences.

As a result of the expansion of remote work, management students will likely work in virtual or hybrid (with a degree of virtuality) teams throughout their coursework and future organizations. Consequently, preparing management students for successful collaboration in virtual environments becomes more critical than ever. This is in line with Rafferty's (2013)

claim that for management educators to deploy workgroup "pedagogical approaches" effectively, they must understand the environment in which student teams operate. Since our research findings underline the importance of virtual communication behaviors, we recommend management educators devote some initial class time to addressing the collaboration problems associated with team virtuality. Instructors might, for example, encourage students early in the forming stage (Tuckman, 1965; Tuckman & Jensen, 1977) to analyze which technology to use depending on their tasks and carefully select the appropriate virtual communication behaviors to improve their teamwork interactions. They may also motivate students to think and examine their thoughts, feelings, and behaviors on their challenges in past team interactions using technology-mediated communication and share those previous experiences with their classmates.

Even though we did not explore teaching activities that management educators might use in their courses, our results point out possible avenues for improving students' teamwork, for example, by using virtual communication behaviors. In particular, management educators can raise students' awareness of the importance of selecting the appropriate communication medium for each task by describing when it is advantageous to use leaner media (e.g., to request information) and when it is advantageous to use richer media (e.g., to resolve team conflicts or for creative brainstorming) (Brucks & Levav, 2022). This may be accomplished by providing students with examples, scenarios, and case studies where they can develop an understanding, for instance, of negativity bias and conflict escalation when using e-mails (Byron, 2008). If this is accomplished during the early course sessions, ideally, students will identify the benefits and drawbacks of using different technologies for their collaborative assignments.

Additionally, management educators may encourage students to establish communication norms for responsiveness and virtual interactions at the beginning of their teamwork. This might be accomplished by asking students to have an initial team meeting in which they establish norms of communication—technology-mediated and in-person—or to build, for example, a team charter at the forming team stage to guide their work throughout the semester (W. H. A. Johnson et al., 2021). Although a team charter may not necessarily improve team performance, it may enable student teams to establish specific virtual norms and boundaries. This can help students resolve disagreements and misunderstandings throughout course projects, enhancing their overall team information sharing and, ultimately, team performance**.** Finally, a lack of shared information may make team members less motivated to contribute, thereby increasing the likelihood of free riders and social loafers, common

phenomena in student teams (Jassawalla et al., 2009; Schippers, 2014; Urbig et al., 2016). To reduce the likelihood of freeriding and social loafing, management educators must emphasize to students the need to be particularly supportive and inclusive when using technology-mediated communications, such as by sharing information with all team members and being receptive to the various opinions and perspectives regarding their team project.

### 3.5.3. Limitations and future research

Despite the contributions to research and management education practice, this study has certain limitations and identifies promising future research areas. A first limitation relates to the self-report measure of the degree of virtuality, which required team members' to recall their communications over the semester. Demonstrating acceptable levels of agreement between the reports of members of the same team somewhat addresses this concern. We also improved our measure in Study 2 by asking students about the percentage use of each technology-mediated tool. In general, self-reports are a common way of assessing media use in teams (C. B. Gibson & Gibbs, 2006; Hill et al., 2014; Maynard et al., 2012) and have been shown to align well with actual use. However, we recommend finding ways to objectively verify the degree of virtuality in future research, for example, using experimental designs. However, it is important to note that meta-analytical results indicate that studies employing experimental designs using student samples also have some disadvantages, as they generally show more significant adverse effects of virtuality on team outcomes than longitudinal designs. Interestingly, Purvanova and Kenda's (2021) meta-analysis showed that longitudinal designs using student samples (such as those used in this study) show comparable results to those employing organizational teams.

In addition, we recognize that in Study 1, all variables were self-reported by the students, which may raise the possibility that some of the observed relationships may be biased due to common method variance (Podsakoff et al., 2003, 2012). As recommended by Podsakoff et al. (2003, p.888), we maintained student privacy and decreased assessment anxiety to reduce this common method bias (e.g., asking students to be as precise as possible for a teaching assistant to provide helpful feedback and clarifying that the information would not be viewed or utilized by their instructor). Additionally, to address additional sources of common method source bias, we improved the design of Study 2 by using a multisource and time-lagged design. However, although we measured team performance using a different source, we did measure team information sharing and team virtual collaboration behaviors using the same survey,

which could be another source of common method bias that must be considered when interpreting the relationships between these variables. However, our confirmatory factor analysis revealed that these concepts were perceived as distinct from each other.

Also, it would be fruitful for future research to build on this research to study interventions to teach virtual communication behaviors to management students. For example, management professors can include a case study in their initial sessions emphasizing how to communicate more successfully in virtual environments (e.g., Harvard Business Review cases). Future research may also add additional insights by focusing on how team virtuality influences other team outcomes, for example, team member learning and satisfaction (Wageman et al., 2005). This may involve extended longitudinal study designs that examine a student team's capacity to recover from early misunderstandings caused by technology-mediated interactions and to adjust their communication styles over time. MBA student teams that sometimes work on the same team during the whole 1-or 2-year program may be a good sample to explore this future line of research.

Given the proliferation of new technologies driven by the Covid-19 pandemic, an essential future research direction would be to investigate the efficacy of virtual communication behaviors dependent on the type of virtual communication (e.g., leader vs. richer media). We recognize that the type of technology used might impact how effective virtual communication behaviors improve their students' work. Therefore, we encourage future scholars to acknowledge the impact of team virtuality on their students' work and further investigate these differential technology-mediated tool effects in their courses.

Finally, we did not consider distinct types of courses in our analysis. However, it is essential to acknowledge that the nature of the student team project may affect the effectiveness of virtual communication behaviors. For example, a professor of an innovation course that requires students' teams to perform idea generation or design thinking exercises may need to encourage students to meet in person for creative tasks (Brucks & Levav, 2022). Conversely, a finance course professor asking student teams to evaluate a corporation's financial performance may need to encourage students to use lean rather than richer communication when analyzing data. Thus, we encourage future researchers to explore the impact of team virtuality depending on the tasks and objectives of the course.

## 3.6. Conclusion

In this study, we examined the adverse impact of team virtuality on the performance of on-campus student teams, which are generally not considered virtual teams. We also provided evidence that virtual communication behaviors may enhance this team's performance. We hope that our findings will create greater awareness among management educators regarding the potential adverse effects that team virtuality may have on student team performance, the need to take action to maximize student team success by using effective virtual communication behaviors, and the urgency to prepare management students for the modern virtual workplace.

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# 4. Antecedents and Consequences of Perceiving Time-Based Unresponsiveness

After doing empirical research on an individual-level phenomenon and a team-level phenomenon in virtual environments, this third essay builds theory on the causes and effects of perceived time-based unresponsiveness in virtual environments.

## 4.1. Abstract

The growth in collaborative, virtual, and global work has led to an onslaught of 24/7 task requests from colleagues and made it more difficult to provide timely responses. Existing research consistently suggests that longer response times provoke senders of task requests to react negatively, with negative affect and, in turn, counterproductive behaviors toward the receiver. However, past research lacks clarity regarding when individuals might differentially perceive unresponsiveness, hence when this negative chain of events may be *less* likely to occur. To enhance clarity about this, we define time-based unresponsiveness as a perception at the individual level and offer a theoretical model regarding this perception's antecedents and consequences. Our model highlights that senders' negative reaction to response delays is less likely when senders expect longer response times and are more forgiving of any time-based unresponsiveness they perceive. Our model also highlights these two contingencies' lower likelihood, however, when senders are experiencing time urgency; and this leads us to highlight factors likely to mitigate time urgency's deleterious effects. Lastly, we posit these mitigating effects to be weaker when senders perceive a receiver to be unresponsive *repeatedly* rather than just once or infrequently. We conclude with our model's theoretical and practical implications.

## 4.2. Introduction

> *"One recent survey suggested that the average American's inbox has 199 unread messages. But volume isn't an excuse for not replying. Ignoring email is an act of incivility"* (Grant, 2019)

Consistent with our opening quote, employees have expressed feelings of being ignored and affronted when their task requests have gone unanswered by others in their team or broader work organization. Examples of this include: "Anyone out there?" "Can we PLEASE try to respond?" (Jarvenpaa, Knoll, & Leidner, 1998, p.50-51); "I am disappointed that you haven't reviewed Mia's work and my work…I hope you'll produce the goods" (Piccoli & Ives, 2003, p.374) and "...did anybody see that [my task request]? Is anyone workin' on it?" (Schinoff, Ashforth, & Corley, 2020: 1401). These comments suggest individuals experience negative affect, such as anger (Gibson & Callister, 2010) or disappointment (Zeelenberg, Van Dijk, Manstead, & Van der Pligt, 2000), toward their co-worker. Given the tendency for negative affect to be positively associated with counterproductive work behaviors (Bauer & Spector, 2015; Shockley, Ispas, Rossi, & Levine, 2012), it is unsurprising that senders of task requests whose receivers respond more rather than less slowly (which presumably triggers negative affect) tend to evaluate receivers more harshly (e.g., in terms of competence, attractiveness, and trustworthiness; see Kalman & Rafaeli, 2011; Tatum, Martin, & Kemper, 2018; Walther & Tidwell, 1995), complain about receivers more often (Jarvenpaa & Leidner, 1999), and cooperate with them less (Cramton, 2001).

These patterns suggest that longer time lapses between receivers' receipt of and response to task requests are more likely to provoke senders' negative affect, which increases counterproductive behaviors toward receivers who respond more slowly. An exception to this is Sheldon, Thomas-Hunt, and Proell's (2006) finding that senders generally evaluate a slower-responding receiver's competence *less harshly when they expect the receiver to take longer to respond.* This pattern is consistent with Expectancy Violation Theory's (EVT), which states that individuals tend to more favorably react to those whose actions conform to (rather than disappoint) their expectations (Burgoon, 1993, 2015; Burgoon & Hale, 1988; Burgoon, Newton, Walther, & Baesler, 1989; Burgoon & Walther, 1990). EVT cannot explain, however, why individuals may have different response-time expectations of a particular receiver nor why, even when individuals' response-time expectations are the same, they may react differently to identical response times.

Integrating Expectancy Violation Theory (EVT) with insights from forgiveness research (Bies, Barclay, Tripp, & Aquino, 2016; Fehr, Gelfand, & Nag, 2010) leads us to posit that there are circumstances that influence how individuals who send a task request come to perceive the receiver as unresponsive and then react to this more versus less negatively; Figure 5 depicts the relationships we propose. As such, our model pertains to antecedents and consequences of individuals' perceptions of *time-based unresponsiveness*. We use this term to distinguish this type of unresponsiveness from other kinds that are unrelated to timeliness. Behaviors characterized as unresponsive that are unrelated to timeliness include, for example, interpersonal inattentiveness to others in conversation (e.g., Anderson & Martin, 1995; Coyle & Carmichael, 2019; Reis, Clark, & Holmes, 2004; Sprecher, 2014; Worthington, 2018), refusal to support changes requested by employees and/or customers (e.g., Gibson, Dunlop, & Cordery, 2019; Ingram & Simons, 1995; Luo, 2001), and poor adaptability to organizations' unanticipated schedule changes (e.g., Blount & Janicik, 2001). By identifying antecedents as well as consequences of individuals' perceived time-based unresponsiveness and identifying the circumstances that strengthen or weaken these relationships, we challenge the conventional view that slower-responding receivers generally provoke more negative affect and its associated counterproductive outcomes. The relationships illuminated by our theoretical model also suggest several strategies for: (1) *preventing* perceived time-based unresponsiveness in the workplace and (2) *mitigating* the negative consequences of time-based unresponsiveness perceptions that do occur. These strategies promise to help employees who feel unable to keep up with 24/7/365 work-related task requests without permeating the boundaries of home (Kim & Hollensbe, 2017, 2018) to say "no" to some task requests *without* appearing unresponsive and, thus, suffering associated penalties.

The type of task request that is relevant to our focus on time-based unresponsiveness regards a request requiring action by the receiver (e.g., obtaining, synthesizing, and/or assembling requested information) that *cannot* immediately occur. For this reason, there must be some time lapse between sending the task request and receiving a substantive response from the receiver. We define "perceived time-based unresponsiveness" as *the extent to which a task requestor (sender) perceives the receiver to be untimely in providing information that fully meets the sender's request*. This individual perception by a sender is relevant to contexts involving in-person as well as technology-mediated (e.g., email-based) exchanges since in both of these contexts it is possible for a task request with a time-lagged response to occur.

Our paper makes five contributions. First, to enhance understanding of when and why task senders may vary in their reactions to identical receiver response times, we define senders' perception of time-based unresponsiveness at the individual level and examine likely individual variations in this perception's antecedents and consequences. Explaining these individual variations could not occur in past studies that examined dynamics associated with response-time perceptions at solely the team level (Aissa, Gurău, Psychogios, & Somsing, 2022; Jarvenpaa & Leidner, 1999; Stewart & Gosain, 2006; Tang, 2015).

Second, we highlight that senders' extent of negative affect (if any) toward a receiver they perceive as unresponsive is key in determining how (if at all) negatively they will react to this. This possibility could not even be considered in past studies using solely team-level theory and measures regarding teammates' reactions to slow-responding teammates (e.g., Kalman & Rafaeli, 2011; Tatum, Martin, & Kemper, 2018; Walther & Tidwell, 1995).

Third, we identify two key contingencies—senders' response-time expectation and forgiveness toward the receiver—that determine their extent of negative affect toward a receiver who is slow in providing a substantively complete response. Guided by EVT (described above), we posit that senders receiving a slow response will be less likely to perceive time-based unresponsiveness and, thereby also, less likely to feel negative affect toward the receiver when the receiver's response time is *expected* rather than unexpected. We depart from EVT which identifies harsh feelings and evaluations as likely to occur against norm violators by noting that senders who perceive the receiver to be unresponsive will probably, if they are more forgiving of this, feel less negative affect toward that receiver. We posit this because forgiveness is the *relinquishment* of negative affect toward those perceived to have committed harm (Bies et al., 2016; Fehr et al., 2010), such as someone whose slow response time has delayed task completion. Integrating insights from forgiveness research with EVT thus enables us to amend the mostly pessimistic forecasts of how response delays will affect dynamics at work.

Fourth, we highlight that it is more difficult for senders to have longer response-time expectations and be more forgiving of a receiver they perceive as unresponsive when senders are feeling more rather than less time urgency—both disposition- and situation-based. Therefore, a key part of our theoretical model regards variables associated with the receiver's perceived time constraints that mitigate the deleterious effects of senders' time urgency.

Fifth, we emphasize the need to consider how the frequency with which senders perceive a particular receiver to be unresponsive affects how they react to the receiver. This is because, as depicted by the feedback loop in our model, with each instance that a sender perceives the same receiver to be unresponsive, negative affect toward that receiver ought to intensify, thus making it more difficult for forgiveness (the relinquishing of negative affect) to occur (Bies et al., 2016). This temporal feedback loop coupled with the many other time-sensitive moderating variables depicted in our theoretical model is why our theorizing provides "a temporal perspective" on how task senders come to perceive and react to time-based unresponsiveness.

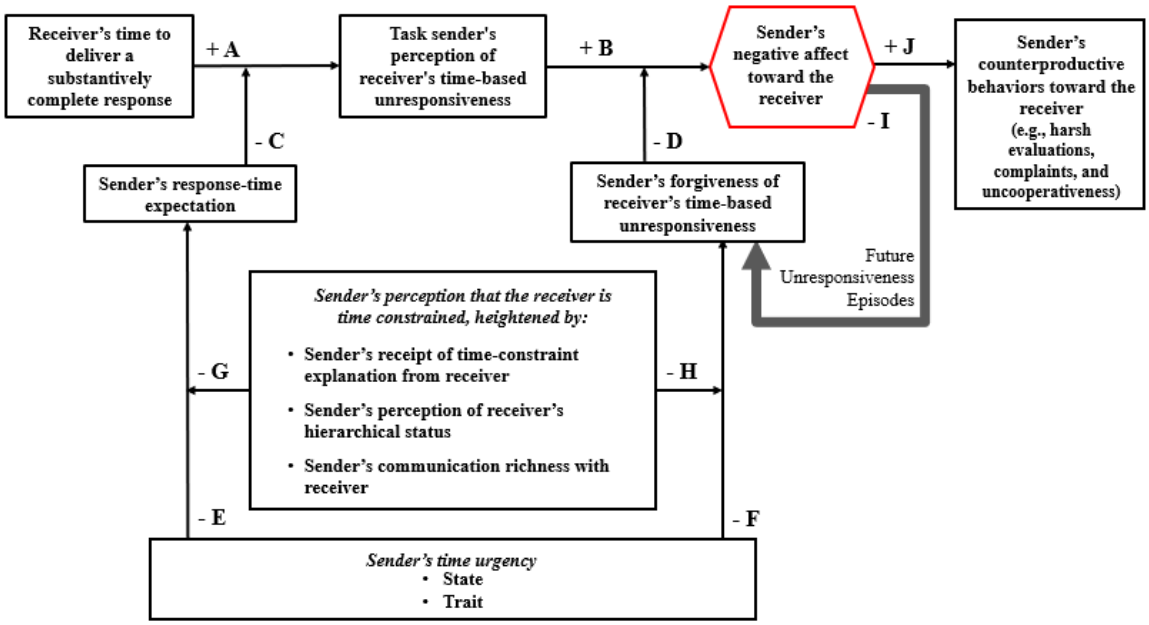


*Figure 5 – Theoretical Model of Perceived Time-Based Unresponsiveness*

### 4.3. Conceptualizing perceived time-based unresponsiveness

There are several ways that our conceptualization of perceived time-based unresponsiveness differs from past work on response-time dynamics. First, time-based unresponsiveness is a perception that is individual-based, not team-based. Our perceptual focus differs, also, from studies that have examined actual time lapse as their exogenous variable. Such studies have referred to actual time lapse as "response latency" (Barber & Santuzzi, 2015; Cambier & Vlerick, 2019; Ho, Hancock, Booth, & Liu, 2016; Kalman & Rafaeli, 2011; Kalman, Ravid, Raban, & Rafaeli, 2006; Lew, Walther, Pang, & Shin, 2018; Moon, 1999), "response speed" (Tatum et al., 2018), "reply speed" (Walther & Tidwell, 1995) and "response rate" (Ledbetter, 2008), "interpost pauses" (Kalman, Scissors, Gill, & Gergle, 2013), "responsiveness" (Downes & McMillan, 2000; Mazmanian, Orlikowski, & Yates, 2013; Pratt, Wiseman, Cody, & Wendt, 1999; Sonnentag, Reinecke, Mata, & Vorderer, 2018), and "silence" (Cramton, 2001; Henttonen & Blomqvist, 2005; Sarker & Sahay, 2004). None of these constructs are perception-based; and, as such, these constructs have prevented scholars from seeing how actual time lapse may have been differentially perceived by individuals.

Another way our conceptualization of perceived time-based unresponsiveness differs from past work on response-time dynamics pertains to our defining this perception as the extent to which a task sender perceives the receiver to have been untimely in delivering a substantively complete response. Note that the two qualities referred to in our definition (i.e., untimeliness and substantive incompleteness) are inseparable from each other. Although these two qualities have been referred to in past work (e.g., Aissa et al., 2022; Stewart & Gosain, 2006; Tang, 2015), they have generally been treated as though each independently contributes to co-workers' or teammates' perception of (un)responsiveness. In contrast to this, we believe untimeliness and substantive incompleteness must both be present if time-based unresponsiveness is to be perceived. For example, a sender who receives a quick response of "got it" or "am working on it" but then nothing else is not likely to perceive responsiveness. As another example, a sender who receives a substantively complete response that comes too late to be utilized is unlikely to perceive this receiver to have been responsive.

Unlike past work regarding response-time dynamics, we focus exclusively on perceived time-based *unresponsiveness.* We do this because negatively violated expectations tend to evoke higher-intensity emotions (Weber & Mayer, 2011) and because, as stated at our paper's outset, our theorizing regards the negative chain reaction to slower rather than faster response

times in the workplace. This means our theorizing pertains to what EVT refers to as negatively violated expectations (i.e., being disappointed by another's actions), specifically, antecedents and consequences of senders perceiving a receiver to be unresponsive.

### 4.3.1. When are slow response times harmful in the workplace?

When goals are interrupted or thwarted at work, this goal blockage typically provokes negative affect in general and, more specifically, anger (e.g., Keenan & Newton, 1984) or frustration (e.g., Fox & Spector, 1999). People who feel negative affect, such as frustration or anger due to their blocked goals, typically want to aggress against those who are blocking the goals they wish to achieve. This tendency is referred to as "the frustration-aggression hypothesis" (Dollard, Miller, Doob, Mowrer, & Sears, 1939). Consistent with this hypothesis, several of the studies cited at our paper's outset found that those who waited a longer time for receivers to respond to their requests or communications tended to complain more about the receiver and be less cooperative toward the receiver (Jarvenpaa et al., 1998; Piccoli & Ives, 2003; Schinoff et al., 2020). Similarly, Chen and Spector (1992) found that employees tended to complain more about co-workers they perceived to be creating various types of work blockages for those seeking help or information; and Fox and Spector (1999) found employees who had more difficulty getting help from colleagues tended to behave more uncooperatively and less helpfully, such as withholding information needed by work colleagues. The positive association between employees' frustration toward work colleagues and their counterproductive behaviors is well documented in Bauer and Spector's (2015) study and Shockley et al.'s (2012) meta-analysis of negative emotions' (e.g., frustration) effect on counterproductive behaviors. Thus, we propose:

> *Proposition 1: The receiver's time to deliver a substantively complete response to a sender's task request is positively associated with the sender's counterproductive behaviors toward the receiver; and this relationship is mediated by the sender's perceiving the receiver to be time-based unresponsive and, in turn, feeling negative affect toward the receiver.*

### 4.3.2. The mitigating effect of senders' response-time expectation

Our logic to this point suggests that people who wait longer to receive a response to their task request will inevitably engage in the negative chain reaction depicted in Figure 5. This pessimism turns more optimistic, however, when we consider the central premise of Burgoon and her colleagues' Expectancy Violation Theory (EVT) that people tend to *more positively*

*evaluate those whose actions match (rather than disappoint) their expectations* (for an elaboration of this communication theory, see Burgoon, 1993; Burgoon & Hale, 1988; Burgoon et al., 1989; Burgoon & Walther, 1990). This means, therefore, that if a longer response time is *expected*, it ought to be evaluated more *favorably* and hence, *not* provoke a negative reaction. Consistent with this, in an experimental study that manipulated participants' expectation of how quickly they would receive a response to their project-related request, Sheldon et al. (2006) found that participants who waited an identical length of time for this response tended to evaluate slower responders less harshly when they expected a longer rather than shorter response time. Under these circumstances, therefore, these participants would probably also have perceived less time-based unresponsiveness on the part of the slower-responding receivers if this measure had been included in the study. Extrapolating from EVT and, more specifically, from Sheldon et al.'s (2006) findings, we propose:

> *Proposition 2: The positive association between a receiver's time to deliver a substantively complete response to a sender's task request and the sender's perception of the receiver's time-based unresponsiveness is weaker when the sender expects a longer rather than shorter response time (illustrated in Figure 5 by Arrow C).*

### 4.3.3. The mitigating effect of senders' forgiveness of perceived time-based unresponsiveness

Perceiving a receiver to be unresponsive may *not* necessarily provoke negative affect in the sender awaiting the receiver's response. This is because the sender may feel forgiving toward the receiver, which will *diminish* "… negative emotions, thoughts, and behaviors … toward the transgressor" (Bies et al., 2016, p.251). Consistent with this description of forgiveness, other scholars have defined this to mean that people have relinquished or released anger, resentment, and vengeful wishes toward a "harm-doer" or "transgressor"—that is, toward one who has brought about harm or unwanted consequences (Bradfield & Aquino, 1999). Consistent with these conceptualizations of forgiveness, scholars have found that people who are more forgiving generally feel less negative affect among other things (Green, Decourville, & Sadava, 2012; Lawler, Younger, Piferi, Jobe, Edmondson, & Jones, 2005; Stoia-Caraballo, Rye, Pan, Brown Kirschman, Lutz-Zois, & Lyons, 2008). For a meta-analytic review of evidence supporting these relationships, see Riek and Mania (2012).

The "harm-doer" in the context we are examining is a receiver perceived as unresponsive. This is because such time-based unresponsiveness may impede task completion (Stewart & Gosain, 2006), harm team performance (Tang, 2015), and thus more broadly, block senders' goal achievement (Gibson & Callister, 2010). If forgiving harm-doers generally lessens negative affect toward them, as found in the studies reported above, it logically follows that the tendency for task senders to feel negative affect toward a receiver they perceive to be unresponsive ought to weaken when the senders are more (rather than less) forgiving of the receiver. Thus, we propose:

> *Proposition 3: The positive association between a sender's perception of a receiver's time-based unresponsiveness and the sender's negative affect toward that receiver is weaker when the sender is more rather than less forgiving toward the receiver (illustrated in Figure 5 by Arrow D).*

### 4.4. How task senders' time urgency affects their reaction to slow-responders

Our logic to this point suggests that the negative chain reaction set into motion by a receiver who is slow in providing a substantively complete response can be mitigated if the sender expects longer response times and feels more forgiving toward the receiver. On the other hand, these two contingencies may be overly optimistic given that, for reasons we explain next, they tend *not* to occur when senders feel more time urgency. How senders' time urgency affects their response-time expectations and their forgiveness of receivers they perceive to be slow in providing a substantively complete response are discussed next, each in turn.

#### 4.4.1. How senders' time urgency affects their response-time expectations of their receivers

People may feel greater "time urgency" for two reasons: They face a deadline and/or have a dispositional tendency to feel time pressed. These two reasons represent "state time urgency" (also referred to as "time pressure;" Maruping, Venkatesh, Thatcher, & Patel, 2015) and "trait time urgency" (Maruping et al., 2015; Mohammed & Nadkarni, 2011), respectively. People who feel time urgent (for either of the latter reasons) perceive "…there is *scarcity* of time available to complete a task, or set of tasks, relative to the demands of the task(s) at hand" (Maruping et al., 2015, p1535, emphasis ours).

In time-pressed situations resulting from an externally imposed deadline, individuals tend to become (1) more "task-oriented" (Gersick, 1988, 1989; Karau & Kelly, 1992; Kelly &

Loving, 2004) and (2) quicker in their task-related responses to each other (Giurge & Bohns, 2021; Langer, Blank, & Chanowitz, 1978; Tyler & Tang, 2003). Consistent with these tendencies, Gersick (1988, 1989) found that team members tended to generally prioritize task-oriented (over social) interactions as their task deadline approached. Gersick referred to this deadline-triggered tendency to become more task-focused as the "completion stage" (Gersick, 1988, p.30). Moreover, the team behaviors she described in this stage consist of members expressing "… urgency about the pace and timeliness of their work finishing on time" (1988, p.27). The tendency for employees under more time urgency to be more task-oriented was also observed by Karau and Kelly (1992), which led them to describe deadlines as attention-focusing (or task-focusing) and propose their attentional focus model. In Karau and Kelly's (1992) laboratory study, they varied how much time pressure team members were under (by manipulating time to finish the task such that this was more for half their sample and less for the other half) and found, just as Gersick (1988, 1989) did, that team members tended to focus more on task-oriented rather than interpersonally oriented interactions when they were experiencing time urgency. Similarly, Langer et al. (1978) found that people who requested to use a copier ahead of others in line were more likely to be accommodated when they indicated urgency, for example, "I'm in a rush!" Emails marked "time urgent" have also been found to generally elicit quicker replies (Giurge & Bohns, 2021; Tyler & Tang, 2003).

Cumulatively, these findings suggest that a commonly accepted social norm under situations of time urgency is to respond as quickly as possible and thus, if possible, *not* to delay. Given that EVT (Burgoon, 2015) suggests social norms shape people's expectations, senders under more state time urgency ought to expect shorter response times from receivers. As such, a negative association should exist between their state time urgency and their response-time expectation.

Senders who for disposition-based reasons feel more time urgent probably also expect shorter response times. This is because individuals with trait time urgency (a dimension of Type A behavior) are generally concerned about the passage of time and how to manage their time to accomplish work and personal goals (Conte, Landy, & Mathieu, 1995; Landy, Rastegary, Thayer, & Colvin, 1991; Shipp & Cole, 2015; Tang, Richter, & Nadkarni, 2020). Such individuals are more likely than those who are "time patient" to worry about elapsed time and hence to express things like "I'm in a rush," with the expectation that others will respond quickly. Senders should therefore expect *shorter* response times when they are under more rather than less time urgency. Thus, we posit:

*Proposition 4: The sender's state and trait time urgency are each negatively associated with the length of time s/he expects a receiver to take to provide a substantively complete response to his/her task request (illustrated in Figure 5 by Arrow E).*

### 4.4.2. How senders' time urgency affects their forgiveness of seemingly unresponsive receivers

People tend to be less forgiving toward harm-doers when they perceive the harm as more severe (see a review of these findings in the meta-analysis by Fehr et al., 2010). Extrapolating from this, senders who perceive their receivers to be unresponsive ought to be less forgiving of this when the time-based unresponsiveness has produced more severe harm. More severe harm resulting from perceived time-based unresponsiveness ought to occur in situations characterized by more (rather than less) time urgency—such as situations with externally imposed deadlines. Indeed, the greater harm of slowly completed work in the presence of a deadline was apparently anticipated by the team members observed by Gersick (1988, 1989) and others whose work we cited above who tended, as deadlines approached, to become more focused on completing the task rather than engaging in social (non-task) interactions.

Senders who are dispositionally more time urgent than time patient ought to also perceive they have suffered greater harm from a receiver they see as unresponsive. This is because, as Rastegary and Landy (1993, p.222) explain, "time-urgent individuals react impatiently to situations that slow them down" and "interruptions are not tolerated because they crowd the already inadequate available time." If senders who feel more time urgency (for reasons relating to a deadline or to the dispositional tendency to view time as scarce) perceive greater harm resulting from a receiver's perceived time-based unresponsiveness, as we have posited above, then more time-urgent senders ought to be less forgiving of the receiver's time-based unresponsiveness (Fehr et al., 2010). Thus, we propose:

*Proposition 5: The sender's state and trait time urgency are each negatively associated with his/her forgiveness toward a receiver s/he perceives as unresponsive (illustrated in Figure 5 by Arrow F).*

Our last two propositions, taken together, suggest that when senders perceive greater time urgency, they will be more likely to expect shorter response times and be less likely to

forgive those they perceive to be unresponsive. This is a recipe for an unforgiving, high-pressure work environment, which has been shown to lead to counterproductive work behaviors (Mitchell, Greenbaum, Vogel, Mawritz, & Keating, 2019). However, this pessimistic forecast fails to consider the tendency for people to amend their normative expectations of others (Burgoon & Hale, 1988) and to be more forgiving of harm-doers (Bies et al., 2016) whose actions are not fully under their control. Guided by this tendency, senders who perceive a receiver to be more severely time constrained will probably relax their normative expectations for shorter response times and their typical unforgiveness of a receiver they perceive as unresponsive. Thus, we next propose factors likely to lead senders to perceive the *receiver* as time constrained since this perception likely mitigates the deleterious effects of time urgency noted above.

### 4.4.3. How deleterious time-urgency effects are mitigated by senders' perception of a receiver's time constraints

As Figure 5 shows, we posit that task senders' perception that a receiver is time constrained is heightened by their: (1) receipt of a time-constraint explanation from the receiver, (2) perception of a receiver's hierarchical status, and (3) frequency of richer (rather than leaner) communications with the receiver. With regard to the first of these three contextual variables, senders are more likely to perceive that the receiver is time constrained when they do (rather than don't) receive an explanation from the receiver indicating this. Indirect support for this comes from research showing that people's explanations for their actions generally influence the perceptions others have of them in the intended direction (Bies & Shapiro, 1987; Bies, Shapiro, & Cummings, 1988; Greenberg, 1990).

Senders' perception of the receiver being time constrained is also more likely to occur when they perceive the receiver to have higher hierarchical status. This is because positions higher in the organization's hierarchy tend to have a heavier workload and broader scope of responsibility (Sherf, Venkataramani, & Gajendran, 2019).

There are two reasons leading us to posit that senders who use richer communications more rather than less frequently with their receiver will be better able to perceive their receiver's time constraints. Communications that are "richer" carry more message cues, such as vocal tone, facial expressions, and other non-verbal expressions; and in contrast, communications that are "leaner" carry fewer of these message cues (Daft & Lengel, 1984, 1986). One reason why richer communications, such as in-person face-to-face interactions and

videoconferencing, enable participants to become aware of others' time constraints is that these types of communications enable participants to potentially see as well as hear cues in each other's work environments that point to demands on their time (for a review, see Raghuram, Hill, Gibbs, & Maruping, 2019). Examples of such cues include the person being interrupted by multiple phone calls, text messages, or other requests from co-workers or (if working from home) from family members as well as by health challenges (e.g., coughing or sneezing, headache, eye-related challenges, broken finger, etc.) that likely impede work productivity. Such cues are less available in leaner communications, such as email or other text-only channels (Daft & Lengel, 1984, 1986; Dennis, Fuller, Valacich, & Dennis, 2008; Dennis & Kinney, 1998; Kirkman & Mathieu, 2005; Spears & Lea, 1992; Valkenburg, Peter, & Walther, 2016; Walther, 1992, 1995). Consistent with this, virtual team research (for a review, see Gilson, Maynard, Jones Young, Vartiainen, & Hakonen, 2015) has shown that using richer communication media, including more in-person face-to-face interaction, reduces the potential for misunderstanding and facilitates shared understanding in virtual teams (Hinds & Weisband, 2003). In addition, management scholars have found that when geographically distant co-workers visited each other's contexts (which is the richest form of communication), co-workers gained significantly more awareness of the other's context, including onsite responsibilities and demands (e.g., Hinds & Cramton, 2014; Mortensen & Neeley, 2012).

A second reason why senders using richer communications with the receiver with greater frequency will probably be better able to perceive the receiver's time constraints is due to the tendency for richer communications to enable participants to have more immediate feedback and interactive communication (Daft & Lengel, 1986). Feedback immediacy enables greater information-sharing spontaneity which, in turn, tends to increase communicators' informality (Hinds & Mortensen, 2005). Moreover, Hinds and Mortensen (2005, p.294) explain that "[a]s people interact informally and spontaneously, more information, particularly contextual information, is shared" ; and this sharing ought to increase understanding of what others are doing. This is less likely to occur in communications such as email, where there is a delay between sending and receiving a message (Gibson & Gibbs, 2006; Hinds & Mortensen, 2005; Hinds & Weisband, 2003). Therefore, the likelihood of a receiver spontaneously making the sender aware of time constraints in the receiver's context is greater when communications this receiver has with the sender are more frequently rich (e.g., in-person or video-based) rather than lean (e.g., solely text-based, as in email).

Why might senders' perception that the receiver is time constrained mitigate the tendency for senders under high time urgency to have shorter response-time expectations? According to EVT, people tend to allow deviations from social norms if they are aware (e.g., through prior knowledge) or become aware (e.g., through direct observation) of relevant "idiosyncrasies" related to the person with whom they are interacting (Burgoon, 2015). To illustrate this, EVT scholars note that people's norms with regard to how physically close they are when conversing with others tend to get amended (i.e., to allow closer physical proximity) when their conversational partner has the idiosyncrasy of a hearing impairment that they know about or observe during their conversation (Burgoon & Hale, 1988). Extrapolating from this, when a receiver's idiosyncrasy pertains to having excessive time demands, and the sender knows about or observes this in the course of their communication, the sender will probably permit the receiver to deviate from the generally accepted social norm of responding quickly to those under time urgency. Thus, we propose:

> *Proposition 6: The tendency for the sender's state or trait time urgency to be negatively associated with the length of time s/he expects the receiver to provide a substantively complete response (as predicted by Proposition 4) is weakened by circumstances heightening the sender's perception that the receiver is time constrained: (a) receiving a time-constraint explanation from the receiver; (b) perceiving the receiver to have higher hierarchical status; and (c) using richer communications with the receiver (illustrated in Figure 5 by Arrow G).*

Senders' perception that the receiver is time constrained ought to also weaken the tendency for senders under more time urgency to be less forgiving of a receiver they perceive to be unresponsive. This is because, guided by attribution theory, forgiveness scholars have predicted and found that people who make external (rather than internal) attributions for harm-doers' actions tend to be more forgiving of them (Bies et al., 2016; see meta-analysis by Fehr et al., 2010). Attributions for a harm-doer's actions that are "external" pertain to factors that are not fully within the harm-doer's control (Harvey, Madison, Martinko, Crook, & Crook, 2014; Kelley & Michela, 1980), such as situational constraints, of which time constraints may be one. Thus, we propose:

> *Proposition 7: The tendency for the sender's state or trait time urgency to be negatively associated with forgiveness of a receiver he/she perceives to be unresponsive (as predicted by Proposition 5) is weakened by circumstances*

*heightening the sender's perception that the receiver is time constrained: (a) receiving a time-constraint explanation from the receiver; (b) perceiving the receiver to have higher hierarchical status; and (c) using richer communications with the receiver (illustrated in Figure 5 by Arrow H).*

Our theorizing to this point has yet to address the possibility that a sender may perceive a receiver to be *repeatedly* unresponsive. With each episode of perceived receiver time-based unresponsiveness, the sender's negative affect toward that receiver probably builds; and as this negative affect intensifies, the sender will be less likely to forgive the receiver (Bies et al., 2016; see meta-analysis by Riek & Mania, 2012). An additional reason why a sender's negative affect toward a receiver perceived to be repeatedly unresponsive ought to intensify is due to the tendency for people who see a person acting consistently across time periods, hence not distinctively in any particular situation, to attribute that person's actions to the person, *not* the situation (Kelley, 1967). We have already noted the tendency for forgiveness to occur less often when harm-doers' acts are attributed to internal rather than external causes (Harvey et al., 2014; Kelley & Michela, 1980). Thus, we propose:

*Proposition 8: With each repeated episode of a sender perceiving a particular receiver to be unresponsive, the sender's negative affect toward that receiver intensifies and, in turn, the sender becomes less forgiving toward the receiver (illustrated in Figure 5 by Arrow I).*

### 4.5. Discussion

Our paper has illuminated the tendency for a negative chain reaction where perceiving a receiver who is slow in providing a substantively complete response as unresponsive triggers senders' negative affect, resulting in counterproductive behaviors (e.g., harsh evaluations, complaints, and uncooperativeness) toward the receiver. Our theoretical model has also proposed circumstances that *reduce the likelihood* of this negative chain reaction occurring. Understanding dynamics of individuals perceiving time-based unresponsiveness at work is needed today more than ever due to the steady increase in global, virtual and collaborative work that has led to employees receiving an onslaught of 24/7/365 task requests from colleagues (Colbert, Yee, & George, 2016; Nurmi & Hinds, 2020; Zucker, 2021) and, thus, feeling increased need to bring work home (Kim & Hollensbe, 2017, 2018). Given that employees are humans, not machines, it is inevitable that workers will occasionally be unable to respond to all received task requests and, thus also, that workers will occasionally task

receivers as unresponsive. It is therefore essential to understand how to prevent employees from perceiving receivers who are slow in providing a substantively complete response to their task requests as unresponsive and how to mitigate the negative consequences of time-based unresponsiveness perceptions that do occur. Our theoretical model aims to provide this understanding, the theoretical and practical implications of which we discuss next.

### 4.5.1. Theoretical implications

First and foremost, a theoretical implication of our model is that the negative affect senders experience from perceiving a receiver as unresponsive, leading to senders' counterproductive behaviors toward the receiver, will *not* necessarily occur. Understanding how individuals vary in their reactions to identical receiver response times requires an examination of this negative chain reaction at the *individual* level of analysis. This departs from the team-level focus that characterizes nearly all of the scant number of studies that have examined dynamics relating to workers' response-time perceptions (Aissa et al., 2022; Cramton, 2001; Jarvenpaa et al., 1998; Jarvenpaa & Leidner, 1999; Stewart & Gosain, 2006; Tang, 2015). Our individual-level definition of perceived time-based unresponsiveness promises to also facilitate studies of this specific type of perceived unresponsiveness and, ultimately also, an accumulation of knowledge about workers' response-time dynamics. Such knowledge accumulation is currently missing due to the many varied construct labels associated with (un)responsiveness, noted earlier in our paper, as well as the near absence of individual-level studies regarding response-time dynamics.

A second theoretical implication pertains to our identifying senders' negative affect toward a receiver they perceive to be unresponsive as key in determining how (if at all) counterproductively they will respond to this. Recognizing senders' negative affect to perceived time-based unresponsiveness as a key mediator suggests that the danger of perceived time-based unresponsiveness pertains more to how people emotionally react to this than to whether or not they perceive time-based unresponsiveness. For this reason, future studies examining response-time dynamics among employees will ideally include, in addition to senders' negative affect toward receivers they perceive as unresponsive, *negative-affect-defusing* strategies such as those seen in our model (e.g., actions that lengthen response-time expectations and enhance forgiveness toward slow responders). Given that negative affect tends to spread in teams (Barsade & Knight, 2015; George, 1990, 1996), this also suggests that perceptions of time-based unresponsiveness *among teammates* (as opposed to co-workers) are

especially precarious, making it even more important to study negative-affect-defusing strategies associated with perceived time-based unresponsiveness in teams. Such strategies in team contexts could include, for example, establishing response-time norms, minimally including those relating to how to update teammates on time delays. Given that past research has linked employees' negative affect to several different undesirable work outcomes, there may be outcomes not yet examined that result from perceiving time-based unresponsiveness. Such outcomes could include stress (Burke, Brief, & George, 1993; Moyle, 1995) and reduced desire to work with co-workers (Allred, Mallozzi, Matsui, & Raia, 1997). Examining time-based unresponsiveness perceptions at the individual level in team settings promises, too, to enable studies of response-time dynamics among workers at multiple levels of analysis.

A third theoretical implication pertains to our identifying that senders who are perceiving time urgency are less likely to engage in negative-affect-defusing strategies. Understanding this suggests the need to assess the senders' time-related circumstances when predicting how senders will react to receivers' slow response time. To do this, future studies of response-time dynamics could include time-related factors that go beyond the sender's time urgency. Examples include team or organizational norms emphasizing speedy response times or cultural values reflecting different orientations toward time. Examining these contextual variables will be facilitated by studies in natural organizational settings in various country locations. Such studies would be a needed departure from those comprising most of the literature regarding response-time dynamics, which have tended to occur in the laboratory (e.g., Kalman & Rafaeli, 2011; Sheldon et al., 2006) and to use student teams (e.g., Cramton, 2001; Jarvenpaa & Leidner, 1999).

A fourth theoretical implication is our illuminating the need for senders to be sensitive to the time demands *of those whose help they are requesting.* This is because our model identifies time-pressed senders' typically more negative reactions to slower-responding receivers as less likely when they perceive *the receiver* to be more time constrained. This need for senders to empathize with the time demands of their receivers, even when they themselves feel time constrained, suggests that senders and receivers need to be mutually aware of each other's needs. Such mutual awareness is somewhat similar to what Cramton (2001) called "mutual knowledge" regarding their respective local contexts. Cramton (2001) described this as likely to mitigate harsh reactions to disappointing actions, such as silence, on the part of work colleagues located in a distant location. We extend Cramton's theorizing, however, by highlighting that senders' knowledge of the receiver's "context": (1) needs to be heightened

when senders are *co-located with as well as in a different location from* the receiver; and (2) needs to regard, more specifically, the receiver's time constraints. Also, unlike Cramton, our theorizing highlights the receiver's perceived hierarchical status as another way for senders to *infer* the receiver's time demands. This suggests the need for studies to test how workers react to slower responders whose status is higher than versus equal to or less than their own.

A fifth theoretical implication is our illuminating the need for senders to increase the frequency with which they use richer (rather than leaner) communications with the receiver. Given the greater difficulty of using richer communications, especially when doing this requires coordinating schedules with co-workers or teammates who are located in different time zones, future studies need to determine potential strategies for senders who have only lean communication options to learn about the receiver's local time constraints, and vice versa. Our model alerts management scholars and practitioners to the need to identify such strategies and, ultimately also, identify the circumstances when they are more versus less effective in mitigating negative affect in reaction to slow-responding receivers.

A final theoretical implication is that senders will likely be increasingly less forgiving of the receiver, resulting in a higher likelihood of negative affect and counterproductive behavior towards that receiver, when they perceive that receiver to be *repeatedly* unresponsive. Past studies examining reactions to receivers' response times have generally not assessed the effects of senders perceiving repeated instances of perceived time-based unresponsiveness for the same receiver (e.g., Kalman & Rafaeli, 2011; Tatum et al., 2018; Walther & Tidwell, 1995). Even past longitudinal studies (e.g., Jarvenpaa & Leidner, 1999) have not explored how one episode of unresponsiveness from the same receiver may alter the senders' behavior toward that receiver in a subsequent episode. Uncovering these temporal dynamics will require studies with repeated measures within-person (e.g., Ployhart & Vandenberg, 2010; Shipp & Cole, 2015).

### 4.5.2. Practical implications

Our theoretical model has several practical implications, which pertain to ways to prevent perceptions of time-based unresponsiveness from occurring at work and to mitigate negative reactions to perceiving this type of unresponsiveness. We discuss these practical implications next, each in turn.

Regarding actions that are likely to *prevent* perceptions of time-based unresponsiveness at work, senders could reduce the time urgency of their task requests by ideally sending them well ahead of when a response is needed. Providing the receiver with adequate time to respond may also require senders, before sending their request, to obtain information to understand the receiver's time constraints. Senders may have to proactively seek out this information, which can be facilitated by using online systems that allow colleagues to see each other's schedules—e.g., shared drives for Google or Outlook calendar (Van Den Hooff, 2004). All these actions seem likely to enable senders and receivers to agree on response-time expectations; indeed, they will ideally explicitly discuss this. Obtaining mutual agreement about response-time expectations promises to reduce the potential for the receiver to inadvertently violate unstated expectations (Zucker, 2021). Such agreement is especially needed when senders send multiple task requests to the same receiver; under these circumstances, senders will ideally identify which request needs more immediate attention. A final action that is likely to prevent perceptions of time-based unresponsiveness is selecting work colleagues and team members who are reputed to behave in ways that strengthen "task-based trust," which among other things includes responding rapidly to task requests (Kirkman, Rosen, Gibson, Tesluk, & McPherson, 2002).

Regarding actions that are likely to *defuse* negative affect arising from perceptions of time-based unresponsiveness at work, these include: (1) giving receivers the benefit of the doubt by seeking an explanation regarding their time constraints before making potentially erroneous assumptions about the cause of their time-based unresponsiveness (Grenny & Maxfield, 2017); (2) creating a culture of forgiveness (Fehr & Gelfand, 2012) in which disappointing work behaviors of various kinds are automatically given the benefit of the doubt; (3) keeping senders updated about when and why work on their task request has been delayed and the new estimated time for completing the task; and (4) using communication channels that are as rich as possible, hence with facial and vocal cues in addition to text-based information, to enable senders to hear and see the receiver's time constraints, and thus, be more forgiving when they perceive receivers as unresponsive.

We recognize that using richer (e.g., video-based) communications are easier said than done. This is because *lean* communications, such as email, are commonly used among employees in virtual work environments, a growing trend in contemporary organizations (Kniffin et al., 2021; Raghuram et al., 2019), which has been accelerated by the COVID-19 pandemic (Gardner & Matviak, 2020; Laker, 2020; Rue, 2020). Employees tend to use text-

based (lean) communications even more when those they need to reach are located far away, especially in different time zones (when the "day" is "night" for the other party), making synchronous communication more challenging. The ease of sending and receiving lean communications, such as emails, contributes to over-stuffed inboxes. This further increases the likelihood that employees will be unable to provide substantively complete responses to all emails in a timely manner, hence the likelihood that senders will perceive time-based unresponsiveness. This makes it even more critical to encourage work colleagues and/or team members to not *over rely* on lean communications, but also use richer communications when feasible and task appropriate.

Finally, leaders should raise awareness among their team members about the potentially destructive effects of being perceived as a "repeat offender" in terms of time-based unresponsiveness. Leaders should also communicate the many team-performance benefits of building, instead, task-based trust (i.e., of becoming known for being consistently timely in delivering requested substance to others, cf., Kirkman et al., 2002). They should also set and enforce norms that discourage behaviors that will be perceived as time-based unresponsiveness and help to mitigate the negative effects of those perceptions when they do occur. Additionally, it is important to provide constructive feedback to work colleagues and/or team members who are routinely perceived as unresponsive to help them correct their behaviors; providing this feedback will be eased by including this perception as one of the process metrics used to evaluate employees' performance (Kirkman et al., 2002). Given new work demands on employees' time as workplaces and industries transform (particularly following the global pandemic of COVID-19), leaders need to also alert employees to the likelihood that their co-workers cannot always respond quickly to all task requests, making it critical for employees to keep each other updated on their time constraints.

### 4.6. Conclusion

The rise of collaborative, virtual, and global work in organizations has resulted in employees receiving an avalanche of daily task requests from work colleagues (Colbert et al., 2016). Paradoxically, these increased work demands have also made it more difficult for employees to respond to all these requests in a timely manner. Since, as noted by Shipp and Richardson (2021, p.312), "failures to solve individuals' temporal problems can result in increased problems for the organization," we sought in this paper to advance understanding of when a receiver's delay in responding to senders' task requests is more likely to lead to

perceived time-based unresponsiveness that results in senders' negative affect and, in turn, counterproductive work behaviors toward the receiver. We defined perceived time-based unresponsiveness at the individual level of analysis. Integrating EVT with insights from forgiveness research, we theorized that the negative reaction to a task receiver's time delay is *not* inevitable if senders expect longer response times and are more forgiving of those they see as unresponsive. Although we noted the greater difficulty of the latter two contingencies occurring when senders feel time urgency, we also noted the greater likelihood of each contingency (even among time-urgent senders) when senders perceive the *receiver* as time constrained; this led us to suggest conditions that heighten this perception. Finally, we noted the greater difficulty of weakening negative reaction for perceived time-based unresponsiveness if the culprit is a repeat offender. These proposed relationships, if pursued empirically in future research, promise to enable co-workers and teammates to work productively and cohesively together despite perceiving time-based unresponsiveness, which at least on occasion is inevitable in today's workplace of 24/7/365 global virtual task requests.

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# 5. General Conclusion

## 5.1. Conclusion

In March 2020, the COVID-19 pandemic undeniably accelerated the use of these virtual work environments (Gardner & Matviak, 2020; Laker, 2020; Rue, 2020) in organizations worldwide. For this reason, virtual work has been an important topic of interest for researchers and practitioners in recent years. Since many organizations and employees intend to continue working virtually (see Alexander et al., 2021), knowing how team members can work better in these environments is of practical and theoretical importance.

This thesis focused on advancing research on virtual collaboration and answered the following research question: what factors promote effective collaboration in a virtual context? To answer this question comprehensively, we examined factors across three levels of analysis. First, we examined individual-level factors that foster effective virtual collaboration in the first section. In this section, this thesis investigates the relationship between gender and successful virtual collaboration in teams. Second, we examined team-level factors that facilitate effective virtual collaboration. In this second section, this thesis investigated how the degree of virtuality negatively affects performance in a virtual setting and the role of virtual communication behaviors in supporting effective virtual collaboration. Third, we theorized about factors that promote effective virtual collaboration in dyads. In this section, we investigated key interpersonal factors to mitigate the impact of time-based unresponsiveness.

The factors that promote collaboration in the virtual contexts studied in this thesis are fundamental to advancing knowledge in the field since they are often understudied areas in virtual team research that are key to understanding how to best prepare employees to work in virtual environments. As explained before, the first factors that promote virtual collaboration effectiveness explored in this thesis are individual-level factors. In this section, this thesis studied *gender differences* in the effectiveness of virtual collaboration. This extends research on gender differences in virtual environments by noting that women's abilities and skills may not only allow them to be better virtual leaders, but they can also allow them to overcome the challenges of virtual environments and be more effective at virtual collaboration. In this essay, we underlined the relevance of demographic characteristics such as gender in the effectiveness of virtual collaboration. These demographic characteristics have been overlooked since researchers in this field have focused more on understanding virtual team-level dynamics.

In conclusion, our findings suggest that women understand the challenges of virtual work better, which makes them better equipped with strategies to handle virtual situations. Also, we identify a mediating mechanism for the relationship between gender and effective virtual collaboration: virtual teamwork situational judgment. This mediating mechanism is critical as employees of all genders can be developed if organizations provide employees with training to help them understand the most efficient behaviors in virtual environments.

The second factors investigated in this thesis that promote the effectiveness of virtual collaboration are team-level factors. In this section, this thesis studied the impact of *team virtuality on the performance of on-campus student teams*—teams traditionally considered in-person teams and that, as such, have rarely been analyzed as virtual work environments. We further identified critical virtual communication behaviors that might assist management students in on-campus project teams to enhance their virtual collaboration. In conclusion, our findings suggest that on-campus student teams performance is affected by team virtuality. Also, our results indicate that effective virtual communication behaviors are helpful for students regardless of the degree of team virtuality because they allow them to confront the new challenges of team virtuality effectively. Our findings expand the limited empirical study on the influence of virtual communication behaviors on team performance (e.g., Gibson & Gibbs, 2006; Hill & Bartol, 2016; Jarvenpaa & Leidner, 1999) to more conventional in-person teams, such as on-campus student teams.

Lastly, the dyadic-level factors are the last set of factors that promote virtual collaboration, which are examined in this thesis. In this section, this thesis studied the factors that mitigate *time-based unresponsiveness*—defined as the extent to which a task requestor (sender) perceives the receiver to be untimely in providing information that fully meets the sender's request—and its antecedents and consequences for virtual work. In this chapter, we integrated expectancy violation theory (Burgoon, 1993, 2015; Burgoon et al., 1989; Burgoon & Hale, 1988; Burgoon & Walther, 1990) with insights from forgiveness research (Bies et al., 2016; Fehr et al., 2010) to theorize about the adverse reaction to a task receiver's time-related unresponsiveness. More importantly, we explore the factors that prevent these adverse reactions when senders expect longer response times and are more forgiving of individuals they regard as unresponsive.

Another important objective was for the thesis to include a variety of research methodologies (e.g., quantitative methods and theory building); multilevel models (e.g.,

hierarchical linear modeling and multilevel structural equation modeling); and the use of various statistical tools (e.g., SPSS and Mplus) that would enable me to develop a rigorous methodological approach for my future research. In Chapter 2, we presented an individual-level research model utilizing an undergraduate and graduate student sample and tested it using multilevel structural equation modeling in Mplus. In Chapter 3, we constructed a research model at the team level using two samples of undergraduate students and analyzed it using hierarchical linear modeling in SPSS. Finally, in Chapter 4, we developed a theoretical model for a ubiquitous dyadic-level phenomenon in virtual work: time-based unresponsiveness.

Finally, looking across the studies in this thesis, key themes emerged. First, the characteristics of individuals involved in the collaboration are essential for effective virtual collaboration. This means that some team members are better suited to overcome the challenges of virtual work, but at the same time, other team members can learn how to be more effective in these settings. However, individual characteristics are not enough to have effective virtual collaboration. In addition to these individual characteristics, dyadic interactions and overall team behaviors that promote effective virtual collaboration are crucial. These multilevel factors have important implications because individual characteristics, virtual teamwork situational judgment (Chapter 2), and virtual communication behaviors (Chapters 3 and 4) can be developed with training. Thus, individual-level and team-level factors are critical for organization selection and training programs. Knowing which behaviors work well in these virtual environments can help organizations and teams understand what kinds of norms employees need to follow to collaborate in these contexts. As such, this thesis encourages organizations and management educators to develop these abilities and skills in management students and employees through training.

In addition, the studies presented in this thesis suggest that the degree of virtuality is a crucial factor that may impact effective collaboration at all levels: individuals, dyads, and teams. This suggests that more attention should be paid to the understanding of the degree of virtuality not only for the teams but also for individuals and dyads, even in teams that have lower degrees of dispersion. In conclusion, this thesis suggests that effective collaboration in a virtual setting involves factors at different levels of analysis: the characteristics of the team members (e.g., gender), the behaviors and interactions between team members (e.g., team communication behaviors), and also the interpersonal interactions between dyads.

## 5.2. Limitations

Despite the theoretical and practical contributions explained in detail in Chapters 2, 3, and 4, there are also overall limitations that must be acknowledged. First, the samples collected were student samples. However, research has emphasized the benefits of employing student team samples, such as teams doing the same activity or collecting data at different time intervals (e.g., Balkundi et al., 2019; Breugst et al., 2018; Lanaj & Hollenbeck, 2015; Marrone et al., 2007). Research has also suggested that student teams may resemble work teams (e.g., ad hoc organizational teams) and that many student sample results may be generalizable to organizational teams (Highhouse & Gillespie, 2009). Additionally, Chapter 3 is intended to provide management educators using team projects with recommendations to help their students improve their interactions and performance. Therefore, using student samples is sound and logical. It is important to note that this thesis was developed in the midst of the COVID-19 outbreak, which also limited access to data from organizations. Thus, future research utilizing virtual environments in organizations is recommended because it could broaden the applicability of these findings to a wider range of scenarios and help in identifying boundary conditions.

A second limitation is our sample sizes. However, in Chapter 2, our samples are comparable to those used in studies of individual-level team effects (e.g., Lanaj & Hollenbeck, 2015; Marrone et al., 2007). This is because, despite the fact that students are organized into teams, all of our variables of interest are on the individual level. In addition, in the study with the lowest sample size (Study 2 of Chapter 2), we used methodological techniques (e.g., Bayes multilevel structural equation modeling), which are robust and highly recommended for small samples (González-Romá & Hernández, 2022; Yuan & MacKinnon, 2009).

A third limitation from this thesis is that it is not experimental or quasi-experimental which may have several disadvantages (e.g., causal claims) (Antonakis et al., 2010). However, to overcome some of the challenges of correlational studies (e.g., common source and common method bias) (Podsakoff et al., 2003), we used data from different sources (students, peers, grades) at two different points in time (with a 13-or 14-weeks interval). Future research might benefit methodologically from taking a longitudinal approach that, for example, can examine the development of virtual communication behaviors over time. Future research might also provide additional insights by using experimental designs or field experiments , randomly

assigning teams using different technology mediated mediums and following the influence of these use on students or employees outcomes.

### 5.3. Future research directions

As explained in detail in Chapters 2, 3, and 4, we see several avenues for future research on virtual collaboration. Broadly speaking, future research can expand on Chapter 2 to focus on gendered person-environment fit dynamics. Research on person-environment fit focuses mostly on static assessments of fit. Given that our focus is on characteristics and abilities that individuals can develop over time as well as the fact that the challenges of virtual environment also evolve as a result of new technological advances, an individual P-E fit may vary. Therefore, future research could use longitudinal designs to examine how women-virtuality fit changes over time. This might be accomplished, for instance, by testing virtual situational judgment and various individual-level outcomes at various times, such as before and after a virtual collaboration training, or with and without virtual teamwork experience(e.g., Boon & Biron, 2016; Jansen & Shipp, 2019; Shipp & Jansen, 2011). Because research suggests that in highly collectivistic cultures, gender diversity in teams is negatively associated with team performance (Schneid et al., 2015), future research may examine how cultural contexts affect gender differences in virtual environments.

In addition, future research can expand on Chapter 3 to examine strategies and interventions for teaching virtual communication behaviors to management students. For instance, management educators might include a case study in their introductory sessions that emphasizes how to interact more effectively in virtual environments (e.g., Harvard Business Review cases). Future research may also shed light on how team virtuality affects other team outcomes, such as team member learning and satisfaction (Wageman et al., 2005). This may involve also longitudinal research designs that assess a student team's ability to recover from early misunderstandings resulting from technology-mediated interactions and to adapt their communication behaviors over time.

Finally, Chapter 4 aims at opening new lines of research to understand how individuals vary in their reactions to identical receiver response times. Our individual-level definition of perceived time-based unresponsiveness promises to facilitate studies of this specific type of perceived unresponsiveness and, ultimately also, an accumulation of knowledge about workers' response-time dynamics. Our recognition of senders' negative affect to perceived time-based unresponsiveness as a key mediator suggests that the danger of perceived time-

based unresponsiveness pertains more to how people emotionally react to this than to whether or not they perceive time-based unresponsiveness. For this reason, future research examining response-time dynamics among employees will ideally include negative-affect-defusing strategies such as those seen in our model (e.g., actions that lengthen response-time expectations and enhance forgiveness toward slow responders). Such strategies in team contexts could include, for example, establishing response-time norms. Also, future studies of response-time dynamics could include time-related factors that go beyond the sender's time urgency (e.g., team or organizational norms emphasizing fast response times or cultural values reflecting different orientations toward time). In conclusion, we hope that this thesis opens up a number of new research avenues in neglected areas of virtual team research, such as gender differences, the performance of on-campus student teams, and unresponsiveness in virtual environments.

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